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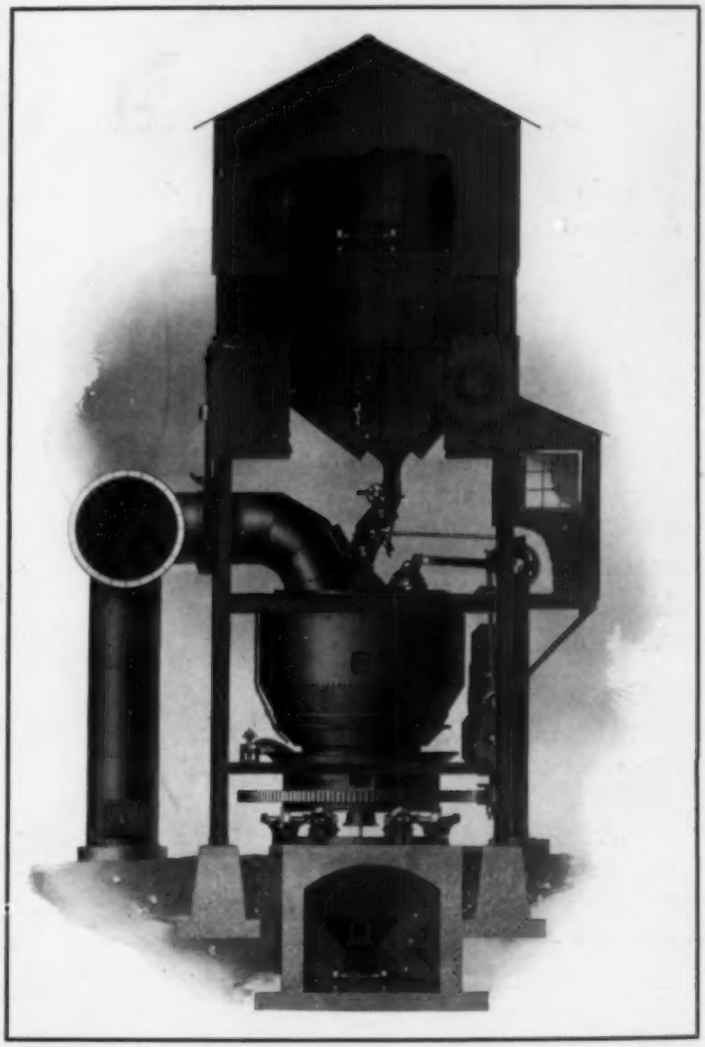

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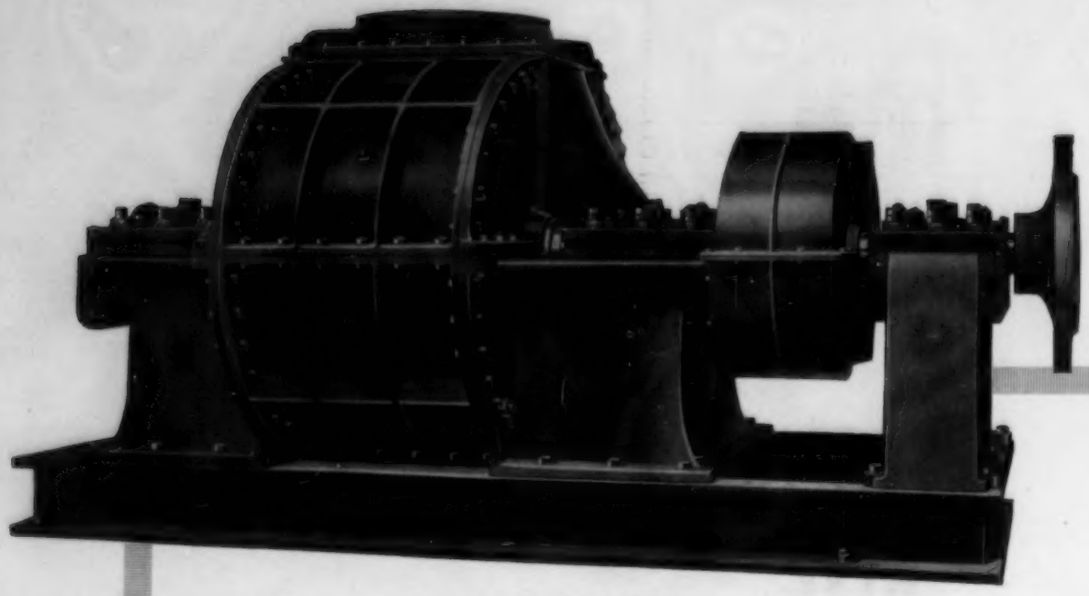
BEST GAS
NON-CLINKERING
LARGE CAPACITY

We Design and Build
Complete Producer Plants

Wellman-Seaver-Morgan Co.

CLEVELAND
NEW YORK
DENVER

Advertisers' Index, page 110. Contents, page 47. "Where-to-Buy," page 54. Engineering Directory, page 92. Employment, page 100. Opportunities, page 102. Second Hand Machinery, page 104. Fill-in and Contract Work, page 108.



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Efficient in Operation—
Durable in Service

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Gas Pumps
Exhausters and Boosters

Connersville Gas Pumps are so constructed that they will run continuously for years on their self-oiling gears and journals, with very little depreciation in efficiency, and with practically no repairs.

The service to which Connersville Gas Pumps, Exhausters and Boosters can be put is almost unlimited.

They can be used for handling air, gas, steam, etc.

Built for any capacity from 25 to 40,000 cu. ft. per minute, and for any pressure between one-half and ten pounds.

Write for Catalog

THE CONNERSVILLE BLOWER CO.

CHICAGO
929 Monadnock Bldg.

CONNERSVILLE, IND.

NEW YORK
114 Liberty Street

THE IRON TRADE REVIEW

Vol. LX Cleveland, June 28, 1917 *No. 26*

Confusion Grows as Supplies Shrink

Wider Attention Being Given to Growing Proposals for More Restricted Price Movements and Market Regulation—Pig Iron Receives Consideration as Government Asks Metal for Itself and Allies

ACTIVE interest, not without concern, in the restoration of a more stable market in iron and steel is growing among producers and consumers. Present conditions are drifting so far from the moorings of precedent and sound business standards that the industry largely is at sea and is becoming more confused steadily. Prices of raw material are so high and still are rising that the speculative element for the producer in selling is not much less than that for the consumer in buying for future delivery. How this is working out in the case of pig iron can be gaged from the statement that the average shipping price today is $20 or more per ton under the prevailing market, while manufacturing costs have been going up by a wide margin. Some producers actually are shipping at a loss. Under these circumstances the increasing proposals of government control of industrial operations and of prices are coming in for more attentive consideration.

Looking to Washington

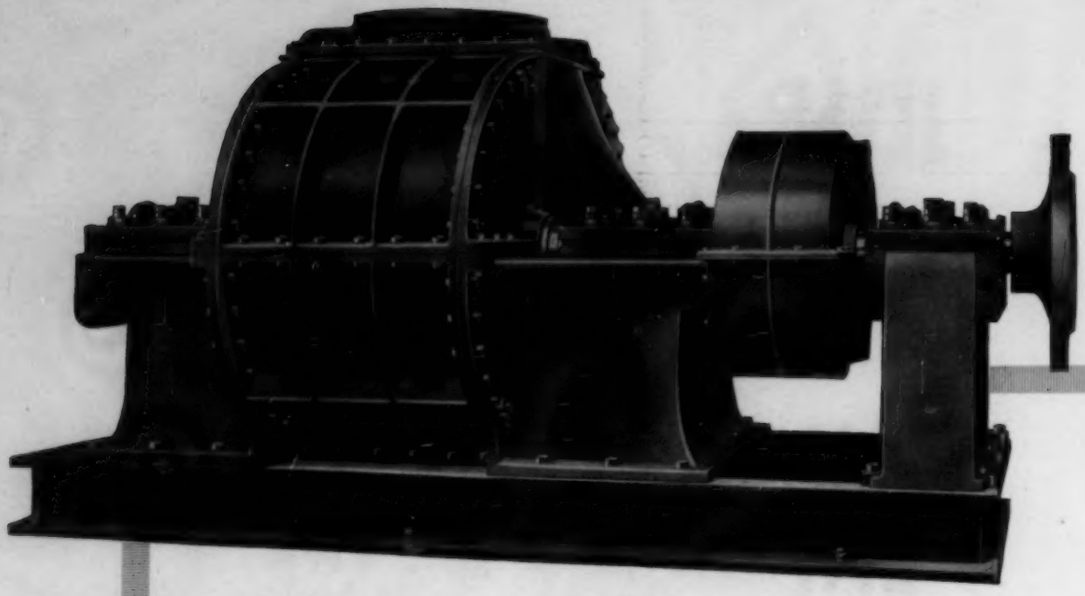
The industry is looking to Washington for a lead as to the course of action demanded by the unparalleled situation. With politics manifestly disputing with the true economic factors, the right to first consideration in attempts at federal supervision, the prospect for an equitable adjustment for all concerned, of the questions involved, is not encouraging. Offsetting this unsatisfactory outlook, however, is the fact that the ablest business talent of the industry constantly is being brought in closer and more effective co-operation with the government. The action of the President in upholding General Goethals in the controversy over ship steel prices reflects an appreciation in that quarter of the fundamental conditions now prevailing. Government war purchases are maintaining their rate of rapid expansion. Large orders for munitions, for ordnance, for cantonments and for a multiplicity of uses are being placed. Ship and hull awards have been increased to 176. The tonnage of material available to outside buyers constantly is shrinking as federal requirements increase. Some large producers have further extended their restrictions on selling and will not take on a pound of new business except for government purposes.

Pig Iron Sweeps On

Pig iron is beginning to figure more prominently in the general trade discussions of the need of more restricted price movements. This apparently has been stimulated by the appearance of large inquiries for the government for its own war account and for that of the allies. Meanwhile the buying pressure in excess of supplies or the unwillingness of producers to sell is sustaining the upward sweep of prices. Bessemer sales at $60, eastern furnace, and $58.50, valley, basic at $54, valley, foundry at $55 to $58, valley, Alabama basic at $50, Birmingham, Virginia No. 2X at $50 to $52, furnace, southern Ohio at $54 to $55, furnace, and eastern Pennsylvania at $50 to $52, furnace, eloquently portray the continuing advance. Large inquiries or sales have been numerous, including 12,000 to 15,000 tons of mixed grades for the General Electric Co.; 15,000 tons of foundry for the Standard Sanitary Mfg. Co.; 12,000 tons of basic for a St. Louis steelmaker; 8000 to 10,000 tons of basic for a Buffalo steelmaker; 5000 to 10,000 tons for an Ohio river consumer, a round tonnage of basic for a new eastern works and numerous other lots. Southern makers are investigating the feasibility of all-water shipments to northern markets.

Full Coke Car Supply

The gyrations in scrap prices have subsided, but the market remains exceedingly strong with further advances in some districts. Some expectations of a reaction are expressed, but these must be considered in connection with the normally highly speculative character of this market. Prompt furnace coke has been sold at $13, ovens. The car supply for the coke regions is more encouraging and for the first time this year has reached 100 per cent.



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THE OPEN HEARTH

Ships Not Talk Wanted

SHIPS are needed in vast numbers at the earliest possible time. The sooner they are built the quicker the war will end. That, it seems plain, is the opinion of Major General George W. Goethals, in charge of the government's merchant shipbuilding program. It is entirely sound. Those who think or pretend to think that he is sacrificing a tremendous tonnage of wooden vessels in order to build steel ships have fallen far short of making a sound case. The wooden ship propaganda has been worked to death. It did not take General Goethals long to observe the absurdity of the formidable paper plans of those supporting it. Because he has looked upon the practical side of the question and has knocked this foolish and dangerous campaign into a cocked hat he has stirred up opposition in certain quarters. It was not possible to make a hard thinking man like General Goethals believe that ship timber or shipwrights could be produced over night. Rosy promises for building vast numbers of wooden ships in short time did not appeal to him. He demanded more than that.

But those who can prove to General Goethals that they can build vessels in short order, either wooden or steel, can do business with him. He has no prejudice as to type. He does, however, have a strong prejudice in favor of facts as against theories. That, in a nutshell, sizes up the attitude of General Goethals with regard to the shipbuilding program. There are some who do not understand his attitude. That is because they have not given close attention to the subject. There are others who want to roil the waters, and merely pretend not to understand his purposes. But they are leaving the general strictly alone.

Now the President has stepped in and is directing matters with his final authority. He has acted as the general public has expected him to act. He has instructed General Goethals to proceed with all speed in building all the ships, both steel and wood, which the actual facilities of the country will make possible in 18 months. This has been General Goethals' position exactly. He has insisted on placing no contracts which were not certain of being fulfilled within the time limit. General Goethals has stood for achievement, for capable and centralized authority, qualities absolutely essential under present conditions. He has the confidence of the general public and of manufacturers of material and equipment. He will inspire the co-operation necessary to bring success. Against his manifest fitness for his task, his opponents have only their personal opinions, savoring strongly of objectionable politics and an untried ability for carrying out a big job. It is no time for appeasing exaggerated and ruffled sensibilities or for experiments. The country demands action.

Those 85 Idle Blast Furnaces

IF THE general public understood more clearly that only 80 per cent of the blast furnaces of the country are producing pig iron, a mass of critical comment would undoubtedly be excited. To the great body of consumers as well as to those patriotic citizens and officials who appreciate the government's imperative need for iron and steel, the percentage would seem unwarrantedly low. And yet, like many other statements, such an assertion, although true, is misleading unless phrased in another way.

The records of THE IRON TRADE REVIEW show that on May 31, 340 coke and anthracite blast furnaces were in blast; 85 were idle. A few of the inactive stacks were out for needed repairs, some of the others were preparing to relight, but the big majority had been idle for years, and showed no signs of revivification.

The May 31 record of active stacks was the best of any date in the past decade. In fact, a search for a better record carries one back to June 30, 1907, when 341 furnaces were in blast. Yet those 341 furnaces produced only 2,237,000 tons; the 340 last month produced 3,414,000 tons, in the face of inadequate coke and car supply.

After the expansion in the eighties, which carried the number of furnaces on Dec. 31, 1888, to 589, a steady decline in the number of stacks was apparent until 1901. The country's capacity rose steadily during the same period, for reasons that are obvious when one recalls the rapid increase in individual furnace capacity that became more pronounced upon the advent of the Mesabi ores. On Dec. 31, 1916, there were 422 coke and anthracite furnaces in the country, against 414 at the close of 1888, but the country's capacity under normal conditions was set at 40,000,000 tons compared with 9,000,000 tons at the opening of 1889.

The majority of the furnaces now inactive took part a comparatively few years ago in setting records that surpassed those of the numerous but smaller furnaces of the nineteenth century. Now these same furnaces compare unfavorably with the big stacks of today and their aggregate production, if they were now relighted, would be comparatively small—but disproportionately important.

Only 80 per cent of the country's furnaces are active, but the percentage of capacity usefully employed is closer to 100 than to 80. The number of active stacks will continue to increase; $50 pig iron

THE OPEN HEARTH

means much even to a furnace whose cost of production was 100 per cent above its big, modern competitor. But the influence of these 85 furnaces on the available supply of pig iron cannot be measured by their rather imposing numbers.

Cars Not Costs the Problem

SUBSTANTIAL increases in freight rates on Lake Superior iron ore and coke have increased further the costs of manufacturing pig iron, which have been climbing rapidly the past two or three years. Ore carrying charges, outlined by THE IRON TRADE REVIEW a week ago, are being studied carefully by pig iron merchants. It is natural to assume that increased costs of manufacturing metal presage further advances in market prices of all grades of pig iron.

Blast furnace managers are worrying more about inbound and outbound shipments of raw and finished commodities, however, than about advanced freight rates and higher quotations on pig iron. The movement of iron ore from lower lake ports to interior points, thanks to the activity of the special committee on iron ore and lake transportation, is regarded as more than satisfactory. Shipments of Connellsville coke, on the other hand, are far from being sufficient to meet demands of the blast furnace trade, despite conscientious efforts of consumers to co-operate with the railroads in moving coke-carrying equipment with the greatest possible dispatch. In order to serve satisfactorily blast furnaces dependent upon beehive ovens for all or a part of their fuel requirements, a 75 to 80 per cent car supply must be diverted to the Connellsville fields. The car supply thus far this year has been 15 to 20 per cent below the minimum requirements of the Connellsville regions. Unless immediate relief is offered, a number of additional blast furnaces will be rendered idle; this will jeopardize the interests of the nation and domestic consumers.

Deferred shipments and the scarcity of coke, caused by the shortage of railroad cars, have combined to send prices of fuel to unprecedentedly high positions. Many blast furnace interests, which covered coke requirements some time ago at $4, ovens, recently have paid as high as $12.50 for rather large tonnages.

The nation needs additional ships to carry men, munitions and foodstuffs to Europe in order to prosecute the war successfully. Railroad cars are needed just as badly to move raw and finished materials in this country. It is imperative that definite and aggressive steps be taken immediately to relieve the general transportation situation in the country. The carrying out of the overseas program depends upon it.

War Promotes Truck Standardization

THE current military truck specifications which have just been formulated by the War department motor transport board after much study and conference with several divisions of the standards committee of the Society of Automotive Engineers, constitute a monumental production of national as well as of engineering importance. The specifications indicate with considerable clearness the goal which should be arrived at by the government in securing military trucks suitable for operation under the worst conditions of service, as determined by data secured in foreign and domestic truck fleet operation.

No unduly drastic administration of the specifications by the government on the motor truck industry is contemplated, sufficient flexibility having been allowed for the adjustment of necessary manufacturing processes. Considering the trucks as being of the load capacities indicated by the original governmental nominal rating, they would certainly not be suitable for regular commercial operation. Considering, however, the real load capacities of the trucks, it is noted at once that the action of the government in promulgating the specifications will have a decidedly gratifying effect on the future production of 3 and 5-ton trucks in this country for commercial service.

So far as the power plant, the transmission system and the axle equipment are concerned, the class *A* military truck, known heretofore as 1½-ton military truck, has a commercial load capacity of 3 tons. Likewise the class *B*, the formerly 3-ton military truck has a commercial load capacity of 5 tons. It is predicted by well-informed engineers that the new government specifications will have a very beneficial effect on the design and satisfactory and economical use of trucks of 3-ton and 5-ton capacity in commercial service. It is fortunate that the specifications laid down for military trucks will result in raising the efficiency of trucks of similar capacity in commercial service. The broad conception which the quartermaster general's office has had of the subject, in consultation with the trucks standards division of the Society of Automotive Engineers, will eliminate the factors which have retarded the adoption of those elements of design which are necessary in the ultimate type of commercial truck.

With the fundamental elements of truck design established, the details are of secondary importance. While there will be occasion for revision from time to time of the details given in the specifications, the fundamental considerations have been determined in such a thoroughly sound way that no really material changes will have to be made in the specifications so long as the present type of truck endures.

Iron and Steel Prices

Corrected to Wednesday Noon

SCRAP, WAREHOUSE AND IRON ORE PRICES ON PAGE 1426a

PIG IRON

(Delivery this year.)

Bessemer valley	$57.00 to 58.00
Bessemer, Pittsburgh	57.95 to 58.95
Basic, Pittsburgh	52.95 to 54.95
Basic, eastern Pa.	49.00 to 50.00
Basic, Buffalo	48.00 to 50.00
Malleable, Pittsburgh	54.95 to 58.95
Malleable foundry, Chicago	55.00
Malleable foundry, Phila.	49.00 to 51.00
Malleable foundry Buffalo	50.00 to 55.00
No. 2 foundry, Pittsburgh	54.95 to 58.95
No. 2 foundry, Cleveland	55.00 to 56.00
No. 2 foundry, Ironton	50.00 to 55.00
No. 1 foundry, Chicago	56.00
No. 2 foundry, Chicago	55.00
No. 2X foundry, Phila.	50.00 to 51.00
No. 2X foundry, N. J. tide	50.25 to 51.25
No. 2X foundry, Buffalo	50.00 to 55.00
No. 2 plain, Philadelphia	50.00 to 51.00
No. 2 plain, N. J. tide	50.25 to 51.25
No. 2 plain, Buffalo	49.00 to 50.00
No. 2 southern, Birmingham	45.00 to 46.00
No. 2 southern, Cincinnati	47.90 to 48.90
No. 2 southern, Chicago	49.00 to 50.00
No. 2 southern, Phila. del.	48.50 to 50.50
No. 2 southern, Cleveland	49.00 to 50.00
No. 2 southern, N. Y.	48.25 to 50.25
No. 2 southern, Boston	49.50 to 50.50
No. 2 south. interior, N. E.	50.00 to 51.00
No. 2 southern, St. Louis	43.40 to 48.40
Virginia No. 2X, furnace	50.00
Virginia No. 2X, Phila.	52.75
Virginia, No. 2X, Jersey City	53.00
Virginia, No. 2X, Boston	53.25
Gray forge, eastern Pa.	48.00 to 50.00
Gray forge, Pittsburgh	52.95 to 53.95
Gray forge, Birmingham	38.00
Silveries 8 per cent, furnace	60.00
Silveries, 8 per cent, Chicago	53.00 to 54.00
Low phos. standard, Phila.	92.00 to 93.00
Low phos. Lebanon, furnace	82.00 to 85.00
Low phos., Pittsburgh	82.00 to 85.00
Charcoal, Superior, Chicago	59.50 to 62.00
Charcoal, Superior, Buffalo	60.00 to 62.00
Charcoal, Birmingham	45.00 to 50.00

COKE

(At the ovens.)

Connellsville furnace	$12.50 to 13.00
Connellsville furnace, contract	8.50 to 9.00
Connellsville foundry, contract	12.00 to 12.50
Connellsville foundry	12.00 to 12.50
Wise county furnace, contract	7.00 to 9.00
Wise county foundry, contract	8.00 to 10.00
Pocahontas furnace, contract	7.00 to 9.00
New River foundry, contract	10.50 to 11.00
New River furnace, contract	7.50 to 10.00

FERRO ALLOYS

Ferro manganese, prompt	$450
Ferro manganese, last half	400 to 425
Spiegeleisen, 20 per cent furnace remainder of year	82.00 to 87.00
Ferrosilicon, 50 per cent, Pitts.	250 to 260
Ferrosilicon, 50 per cent, Pitts., 1st quarter	150.00
Bessemer ferrosilicon, 9 per cent	$89.00
Bessemer ferrosilicon, 10 per cent	90.00
Bessemer ferrosilicon, 11 per cent	92.50
Bessemer ferrosilicon, 12 per cent	95.00
Bessemer ferrosilicon, 13 per cent	100.00

Ferrosilicon prices at Ashland, Ky., Jackson and New Straitsville, O., furnaces.

SEMI-FINISHED MATERIAL

BILLETS

Open hearth, Pittsburgh	$95.00 to 100.00
Open hearth, Philadelphia	90.00 to 110.00
Open hearth, Youngstown	95.00 to 100.00
Bessemer, Pittsburgh	95.00 to 100.00
Bessemer, Youngstown	95.00 to 100.00
Forging, Pittsburgh	115.00 to 125.00
Forging, Philadelphia	115.00 to 125.00
Forging, Chicago	100.00

SHEET BARS

Open hearth, Pittsburgh	$105.00 to 110.00
Open hearth, Youngstown	105.00 to 110.00
Open hearth, Cleveland	110.00
Bessemer, Pittsburgh	105.00 to 110.00
Bessemer, Youngstown	105.00 to 110.00

WIRE RODS, MUCK BAR, SKELP

Wire rods, Pittsburgh	$95.00 to 100.00
Muck bar, Pittsburgh	80.00
Grooved skelp, Pitts., nom.	4.00c to 4.50c
Sheared skelp, Pitts., nom.	4.50c to 5.00c

SHAPES, PLATES AND BARS

Structural shapes, Pitts.	4.00c to 5.00c
Structural shapes, Phila.	4.509c to 4.659c
Structural shapes, N. Y.	4.519c to 4.669c
Structural shapes, Chicago	4.69c to 5.44c
Tank plates, Chicago	8.00c to 9.00c
Tank plates, Pitts. (con.)	4.50c to 5.50c
Tank plates, Pittsburgh	8.00c to 10.00c
Tank plates, Philadelphia	8.159c to 10.159c
Tank plates, New York	8.169c to 10.169c
Bars, soft steel, Chicago	4.75c to 5.00c
Bars, soft steel, Pittsburgh	3.75c to 4.25c
Bars, soft steel, New York	4.169c to 4.669c
Bars, soft steel, Phila.	4.159c to 4.659c
Cotton ties, Pitts., June	$2.10
Bar iron, Chicago	4.00c to 4.25c
Bar iron, Philadelphia	4.159c to 4.409c
Bar iron, Cleveland	3.50c
Bar iron, New York	4.169c to 4.419c
Bar iron, Pittsburgh	4.75c
Hard steel bars, Chicago	4.00c to 4.25c

RAILS, TRACK MATERIAL

Angle bars, Pittsburgh, base	3.25c to 3.75c
Angle bars, Chicago, base	3.25c
Standard bessemer rails, mill	$38.00
Stand. open hearth rails, mill	40.00
Light rails, 25 to 45 lbs., Chic.	65.00
Light rails, 25 to 45 lbs., Pitts.	70.00 to 80.00
Relayers, standard, mill	38.00 to 40.00
Relayers, light, Chicago	40.00
Relaying rails, light, St. L.	58.00 to 60.00
Spikes, railroad, Pittsburgh	4.25c to 4.50c
Spikes, railroad, Chicago	4.25c
Track bolts, Pittsburgh	5.50c to 8.00c
Track bolts, Chicago	5.25c to 5.50c
Tie plates, Chicago	$60.00 to 65.00

WIRE PRODUCTS

(To jobbers; retailers 5 cents more.)

Wire nails, Pittsburgh	$4.00
Coated nails, Pittsburgh	4.00
Plain wire, Pittsburgh	3.95
Galvanized wire, Pittsburgh	4.65
Polished staples, Pittsburgh	4.15
Galvanized staples, Pittsburgh	4.85
Barb wire, painted, Pittsburgh	4.15
Barb wire, galvanized, Pitts.	4.85
Cut nails, Pittsburgh	4.50

CHAIN, PILING, STRIP STEEL

Chain, ⅜ in. proof coil, Pitts. 7.50c

Sheet piling, base, Pittsburgh 3.50c to 4.00c

Cold rolled strip steel, hard coils, 1½ inches and wider by 0.100 inch and heavier, base per 100 pounds, 9.00c.

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SHEETS

(In cents per pound.)

SHEET MILL BLACK.

No. 28, open hearth, Pitts.	9.00c to 9.25c
No. 28, bessemer, Pitts.	9.00c to 9.25c
No. 28, open hearth, Chgo.	8.19c to 9.19c

TIN MILL, BLACK

No. 28, open hearth, Pitts.	9.00c to 9.25c
No. 28, bessemer, Pitts.	9.00c to 9.25c

GALVANIZED

No. 28, open hearth, Pitts.	10.25c to 11.50c
No. 28, bessemer, Pitts.	10.25c to 11.50c
No. 28, open hearth, Chgo.	10.19c to 11.19c

BLUE ANNEALED

No. 10, open hearth, Pitts.	8.00c to 8.50c
No. 10, bessemer, Pitts.	8.00c to 8.50c
No. 10, open hearth, Chgo.	8.19c to 9.19c
No. 10, open hearth, Phila	8.159c

TIN PLATE

(Per 100 lb. box.)

Tin plate, coke base, nom. 10.00c to 15.00c

IRON AND STEEL PIPE

(Prices adopted June 18, 1917.)

Steel

Diameter in inches.	Black. Per cent off.	Galv. Per cent off.
¼ to 3, butt	42	28½

Iron.

(Prices adopted May 1, 1917.)

Diameter in inches.	Black. Per cent off.	Galv. Per cent off.
⅛ to 1½, butt	38	22

BOILER TUBES

(Price adopted April 2, 1917.)

Steel, 3½ to 4½ inches, l. c. l.	34
Iron, 3½ to 4½ inches, l. c. l.	28

CAST IRON WATER PIPE

(Class B Pipe.)

Four-inch, Chicago	68.50
Six-inch and over, Chicago	65.50
Four-inch, New York	68.50
Six-inch and over, New York	65.50
Four-inch, Birmingham	58.00
Six-in. and over, Birmingham	55.00

Class A pipe is $1 higher than Class B.

HOOPS, BANDS, SHAFTING

Hoops, Pittsburgh	6.00c to 6.25c
Bands, Pittsburgh	5.75c to 6.00c
Shafting, Pittsburgh, carloads	5 off to list

RIVETS

Structural rivets, Pittsburgh	5.25c
Boiler rivets, Pittsburgh	5.35c
Tinner's rivets, Pittsburgh	40 off

NUTS AND BOLTS

(Delivered within 20-cent freight radius.)

CARRIAGE BOLTS

(⅜ x 6 inches, smaller and shorter.)

Rolled thread	40
Cut thread	35 and 2½
Larger or longer	25

MACHINE BOLTS

(⅜ x 4 inches, hot pressed nuts.)

Rolled thread	40 and 10
Cut thread	40
Larger and longer	30
Cold pressed, semi-finished, hexagon nuts	50 and 10
Gimlet and cone point lag bolts	45

NUTS

Hot pressed, square, blank	$4.10 off
Hot pressed, square, tapped	1.90 off
Cold pressed, square, blank	1.70 off
Cold pressed, square, tapped	1.50 off
Hot pressed, hexagon, blank	1.60 off
Hot pressed, hexagon, tapped	1.40 off
Cold pressed, hexagon, blank	1.60 off
Cold pressed, hexagon, tapped	1.40 off

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products June 27, average for May, 1917, average for March, 1917, and average for June, 1916. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices June 27, 1917.	Average prices May, 1917.	March, 1917.	June, 1916.
Bessemer pig iron, Pittsburgh..	$57.00	$44.95	$37.45	$21.95
Basic pig iron, Pittsburgh.....	52.00	42.15	32.85	18.95
No. 2 Foundry pig iron, Pitts..	54.00	43.55	36.50	19.50
No. 2 Foundry pig iron, Chgo..	55.00	43.25	35.75	19.00
Lake Superior Charcoal, Chicago	59.50	49.25	37.50	19.75
Malleable, Chicago	55.00	43.25	35.75	19.50
Southern No. 2, Birmingham...	46.00	35.75	24.50	15.00
Southern Ohio No. 2, Ironton..	54.00	38.60	33.00	18.50
Basic, eastern Pa.....	49.50	40.75	34.50	19.25
No. 2X, Virginia, furnace.....	50.00	41.00	34.00	18.00
No. 2X foundry, Philadelphia...	50.50	43.25	37.25	20.00
Ferro mang., delivered.....	450.00	425.00	275.00	175.00
Bessemer billets, Pittsburgh....	95.00	85.00	67.00	41.25
Bessemer sheet bars, Pittsburgh	95.00	88.00	67.00	41.25
Open hearth sheet bars, Pitts..	105.00	88.00	67.00	41.25
Open hearth billets, Pittsburgh.	105.00	85.00	67.00	41.25
Steel bars, Pittsburgh.....	3.75	3.50	3.21	2.50
Steel bars, Chicago.....	4.44	3.84	3.40	2.69
Iron bars, Philadelphia.....	4.409	4.109	3.509	2.559
Iron bars, Cleveland, local del'y	4.25	3.25	3.00	2.40
Iron bars, Chicago mill.....	$4.50	$3.39	$3.00	$2.35
Beams, Chicago	5.44	4.34	3.65	2.69
Beams, Pittsburgh contract.....	4.50	4.00	3.46	2.50
Beams, Philadelphia	4.659	4.659	3.759	2.659
Tank plates, Pittsburgh.....	8.00	4.50	4.20	2.75
Tank plates, Chicago.....	8.19	5.49	4.59	3.09
Tank plates, Philadelphia.....	10.159	7.559	5.659	3.909
Sheets, blk., No. 28, Pittsburgh	9.00	7.00	5.05	2.92
Sheets, blue anld., No. 10, Pitts.	8.00	6.65	4.70	3.10
Sheets, galv., No. 28, Pittsburgh	10.25	8.82	6.72	4.79
Wire nails, Pittsburgh.....	4.00	3.50	3.16	2.50
Connellsville fur. coke, contr...	9.00	8.00	7.60	2.60
Connellsville fdy. coke, contr...	12.50	8.50	6.90	3.50
Heavy melting steel, Pittsburgh	45.00	28.40	23.50	16.25
Heavy melting steel, eastern Pa.	39.50	26.00	23.75	15.75
Heavy melting steel, Chicago...	40.00	28.75	23.00	15.25
No. 1 wrought eastern Pa.....	57.50	40.75	30.50	20.75
No. 1 wrought, Chicago.....	45.00	32.50	25.75	15.25
Rerolling rails, Chicago.....	50.00	36.75	27.25	16.25
Car wheels, Chicago.....	40.00	27.25	20.25	12.50

*Seaboard

(For Additional Prices See Page 1426a)

Government Enters Pig Iron Market

Seeks Large Tonnage for Itself and Allies—Makers Considering Prices on This Business—Vigorous Buying Continues and Prices Still Advance—Alabama Basic Hits $50 and Valley Iron $54

Pittsburgh, June 26.—The United States government and its allies are figuring on large quantities of steelmaking and foundry pig irons for prompt and future delivery. It is probable that producers will name formal prices on iron to the government and its allies at an early date, although it is not believed that these figures will apply to extended delivery, on account of the rapidly increasing cost of production. It is conservatively estimated that the inquiries of this nation, England, France and Italy now involve 60,000 to 75,000 tons. Quotations continue to advance all along the line. All grades are selling at least $2 a ton above prices prevailing a week ago. Bessemer pig iron has been sold at $57.50, valley, and reports frequently are heard of sales at $60. Many market observers say the $60 price will be established by July 1. A rather large block of basic has been sold at $54, valley, and scattering lots involving from 1000 to 5000 tons were purchased last week at $51 and $52, valley. Foundry has jumped spectacularly from $53 to $58, several sales being reported at the latter figure for delivery the first half of 1918. Malleable is equally as strong as foundry, and gray forge is not far behind. A week or 10 days ago, a nearby furnace sold about 5000 tons of gray forge on the basis of $50, valley. Pig iron producers continue to be hampered seriously by deferred shipments of coke. Railroads have promised relief, but the traffic situation continues decidedly unsatisfactory.

Eastern Prices Rise Steadily

Philadelphia, June 25.—While the pig iron market in this district has been fairly active during the past week, important single transactions were lacking and the greater portion of the business placed was comprised of lots involving less than 1000 tons each. Scarcity of iron, however, and the rapidly advancing production costs, have led to higher prices. For foundry, $50, eastern Pennsylvania furnace, now is the absolute minimum for any grade for any shipment; even gray forge now is held at this figure. Most makers now ask $51 and $52, furnace, for western Pennsylvania No. 2X, for any shipment. At least three furnaces are quoting these prices only for immediate acceptance. Fair tonnages already have been sold by a more distant maker for first half at slightly less than $54, Philadelphia. The furnace booking this business today advanced another $1. Virginia iron has figured more actively, due to increased offerings and a good tonnage in the aggregate has been taken at $50, furnace, for No. 2X and $52, furnace, for No. 1X, for this year. Quotations on high silicon Virginia for this year range above $60, furnace. Virginia No. 2X for first half during the week has sold as low as $47.50, furnace. Southern iron at present is not figuring in this market, excepting for a few resale lots. The leading inquiry for steelmaking iron during the week was from a prospective steelmaker whose plant now is in process of construction; this interest asked for prices on an indefinite lot of basic, deliveries to commence in September, at the rate of 1500 tons monthly. Current quotations on basic run as high as $55, but some tonnage was offered during the week at $50. Bessemer apparently now cannot be had at less than $55, eastern furnace. Standard low phosphorus is quiet and

continues to be quoted at $92 to $93, Philadelphia. Copper-bearing low phosphorus is quoted at $85, furnace, minimum.

Large Inquiries in East

New York, June 26.—Demand for foundry iron has expanded materially. Sales to nearby consumers involve fully 10,000 tons and new inquiry is considerable. The largest single inquiry is from the General Electric Co. for 10,000 to 15,000 tons of high and medium silicon foundry for last quarter and first half, principally the latter. This buyer also wants about 1500 tons of low phosphorus. A Newark, N. J. melter took 3000 to 3500 tons of No. 2X for first half at $50, eastern Pennsylvania. This was distributed among three makers. The same melter inquired on a tonnage for the last half of 1918 but no business for that position yet is reported. Numerous lots around 500 tons each and at least two 1000-ton sales were placed. Foundry is at a minimum of $50, eastern furnace, for any grade for any shipment. Asking prices on No. 2X now generally are higher at least for this year. Considerable tonnage for this year has been booked at $52, eastern furnace, and where $51 is being quoted for this year it generally is only for immediate acceptance. On next year, while $50 is the highest that has been done on sizeable tonnages, $51 and $52 have been obtained for small lots. A number of furnaces are not making any quotations. Central Pennsylvania foundry has been sold at $49 to $50, furnace, for first half. The minimum now is $52, furnace, for any shipment. One maker is not offering for next year and quotes nothing less than $55, furnace, for this year. The lowest price heard on Buffalo iron of late is $50, furnace, for No. 2X. Considerable gray forge was sold here this week around $43 to $45, eastern Pennsylvania. A fair-sized tonnage yesterday went at $49 and nothing under $50 now is obtainable. The leading Virginia maker after having been out of the market for some time, has opened its books for first half on the basis of $50, furnace, for No. 2X. A Buffalo district consumer is out for 8000 to 10,000 tons of basic for first half. A Perth Amboy, N. J., steelmaker who asked for 5000 tons of first quarter basic has withdrawn. New export inquiries include several thousand tons of basic for Japan and 2000 tons of bessemer for Italy.

Basic Sales are Numerous

Cleveland, June 26.—A steady inquiry and a growing shortage of iron continue to produce high prices. Basic especially is in demand. A sale of 5000 tons for first quarter was closed at $54, valley. An Erie consumer, who recently bought 5000 tons for first half, has inquired for 2000 or 3000 tons additional for last quarter. An Ohio river melter has placed 5000 to 10,000 tons for delivery this year at $54, valley. The Trumbull Steel Co. has been asking for additional tonnage for the first half, although it will not begin steelmaking for several months. Recent purchases by local steelmakers for first half are placed at about 20,000 tons. No. 2 foundry for last quarter and first half has been sold at $55, furnace, and local makers who were making quotations said that they would not accept less. A fair amount of Virginia for last half has been sold in this district at $50, furnace, for No. 2X, or $53.20, delivered. Effective today, these prices have been advanced $2. Silvery iron is much sought and is exceedingly scarce. A local buyer took 300 tons of 8 per cent additional for first half at $75, southern Ohio furnace, increasing recent purchases to about 1000 tons. A steelmaker asked 1000 to 2000 tons of 7 to 9 per cent for prompt and 3000 tons for first quarter. This material is wanted for export business. A number of foundrymen in this territory, who are uncovered for first half, are holding off and will not buy until they have contracts booked for castings for that period.

Bessemer at $60

Eastern Maker Sells on This Basis—Big Tonnage for Camps

New York, June 27.—A large tonnage of bessemer for delivery over an extended period has been sold by an eastern maker at $60, furnace.

It is estimated that 50,000 square feet of cast iron radiation will be required for the United States army cantonment camps being located at various parts of the country. For the manufacture of this amount of radiation, it is expected that at least 75,000 tons of pig iron will be required.

Northern Iron Grows Scarce

Chicago, June 27.—Makers of northern iron in the Chicago district are selling only in small tonnages, since production up to July 1, 1918, practically is under contract. It is estimated that less than 5 per cent remains unsold. No. 2 foundry, malleable and basic continues firm at $55, furnace, for any delivery now under negotiation. Although no activity has developed for delivery during last half of 1918, one such inquiry has been received on which $55, furnace, was quoted. No sales are known to have been made so far in the future. An inquiry for charcoal iron for last half of next year has also been received from an Illinois manufacturer, but no quotation has been made. Quotations on southern iron are difficult to determine. A recent sale to an Indiana manufacturer of agricultural implements involving 5000 tons is said to have been at a shade over $42, Birmingham, for the first half of 1918. Another sale of 1200 tons for the same delivery is said to have been made at $43.50, Birmingham. A leading interest has offered 3000 tons of low silicon, running 1.50 to 2.25 per cent, at $44.50, Birmingham. Lake Superior charcoal iron still is quoted at $59.50 to $62, delivered, Chicago, for first half of 1918. It appears almost impossible to place further tonnage for this year. The Virginia Iron, Coal & Coke Co. has issued a new schedule for its Roanoke iron for first half of 1918. This ranges from $49.25, furnace, for 1.50 to 2 per cent silicon to $53 for 3.50 to 4 per cent silicon. The freight rate to Chicago is $3.36. Jackson county silveries for the first half have been quoted at $80, furnace, for 8 per cent. A tonnage of resale, 8 per cent, has been sold at $65 to $75, furnace. Melters are meeting with considerable delay in deliveries, especially from the south, although the same condition pertains partially, to northern furnaces. One Tennessee stack is said practically to have defaulted on some lower-priced contracts, and negotiations now are on to adjust the differences.

Sanitary Company Wants Tonnage

Cincinnati, June 26.—Quotations continue to advance, and a few furnaces in the south have marked up to $50, Birmingham, for this year, and to around $48 for the first half of next year. Only a few special lots have been sold as high as $50, and these were for prompt movement. The minimum price for nearby shipment now is $46, and this can only be done with a few interests. Contracting has fallen off to some extent, and inquiries are fewer. The largest one out is from the Standard Sanitary Mfg. Co., which calls for a mixed lot of about 15,000 tons, most of which is for shipment next year. Northern foundry prices vary a great deal. It is generally understood that $55, southern Ohio furnace, is the price for this year, but a little tonnage might be parceled out to old customers around $54. Basic and bessemer are so scarce that almost any figure can be obtained when the

metal can be obtained. About 12,000 tons of Alabama basic for December-March shipment were sold to St. Louis territory. The Virginia foundry irons are again very scarce, although several sales were made in this vicinity the latter part of last week. Some Ohio 8 per cent silvery brought as high as $80, furnace, for shipment to a Michigan consumer this year. Bessemer ferrosilicon has sold as high as $100, furnace, for 10 per cent. This covered only carload lots for first half shipment.

Heavy Inquiry at St. Louis

St. Louis, June 25.—Pig iron prices in this market continue to soar. Excitement among dealers and consumers increases in direct ratio with the advancing cost and scarcity of metal. Inquiries are pouring in from all quarters, those before dealers during the past 10 days easily aggregating 50,000 tons. For the most part, these orders are being turned down. Inadequacy of transportation facilities, especially from the south, continues a factor. A leading dealer returning yesterday from Birmingham says conditions there were never worse. It is virtually impossible to get cars, and a plan is being discussed for moving tonnage destined for the middle west by water, via the gulf and up the Mississippi river. This dealer declared he had 500 tons near Birmingham which he ordered out early in February, but to date not a pound has moved. The most notable inquiry reported last week was for 20,000 tons basic by the National Enameling & Stamping Co. at Granite City, Ill. An inquiry for 3500 tons of basic came from Charles City, Ia.; one for 1100 tons from Peoria, Ill., and for 600 tons from the Belleville, Ill., district. Actual transactions were confined to off carloads. Two cars of No. 2 foundry brought $48.40 f.o.b. St. Louis. It is difficult to arrive at accurate quotations, but the range for No. 2 southern lies between $43.40 and $48.40, f.o.b. St. Louis, depending on delivery.

Southern Basic Brings $50

Birmingham, Ala., June 26.—A heavy tonnage of basic iron for delivery from October to April has been sold by the Woodward Iron Co. at $50, Birmingham. Prices went up again during the week and $42 now is being asked for No. 2 foundry for delivery over the first half. For last half of this year $45 is asked. Several sales, ranging between 500 and 2500 tons, have been recorded at the new price. One of the active companies of this district has announced that a policy of advancing quotations $1 per ton when 10,000 tons had been disposed of has been adopted. Twice that amount was sold during the week. Three or four of the furnace companies continue out of the market though they are receiving numerous inquiries. Sales for delivery during the first half of 1919 closed to date will call for a large proportion of the probable make. There is not much iron left for the last half of 1917. Sales are again reported for delivery during the last half of the coming year. If furnaces would quote so far ahead a considerable tonnage could be disposed of for the entire next year's delivery. Deliveries are better, though the larger proportion of the business being moved is on old contracts, at prices much under those now prevailing.

Coke at Historic Level

48-Hour Fuel Sells at $13 and Higher Reported—Car Supply Reaches Best Point of Year

Pittsburgh, June 26.—Forty-eight-hour coke for immediate delivery has commanded $13, ovens, the historically high price established last February, when a famine of fuel existed as the result of congested traffic conditions. Small lots are reported to have been sold at as high as $13.50, ovens, and talk of $15 coke is heard. The car supply is regarded as more satisfactory than at any time this year; it was estimated at 100 per cent yesterday and 50 per cent today. The supply was 68 per cent last week, and 63 per cent the week before. The supply the first three weeks of June was about 10 per cent above the average of the first five months of the year. As previously pointed out, railroad officials have been directed by the national defense council to divert a greater number of cars to the Connellsville coke regions. If a 75 per cent supply is enjoyed, beehive ovens will be able to meet blast furnace demands, it is believed. The labor situation is causing apprehension. Generally, coal miners and coke drawers have been working only part time for the last few months. The adoption of legislation prohibiting the sale and distribution of alcoholic liquors will tend to solve the labor situation in the coal mining regions. Production the week ending June 16, was 354,459 tons, compared with 361,088 tons the week before, according to *The Connellsville Courier*.

Prompt Fuel at $13

Cincinnati, June 25.—Both furnace and foundry coke that can be shipped promptly bring fancy prices. In both the Connellsville and Wise county fields $13 per net ton at oven is no uncommon figure for foundry coke that can be moved to suit the customer's requirements. Furnace coke has even brought as high as $13, but only in a few exceptional cases. The average prompt quotation on furnace coke is around $11 to $11.50, and on contract at from $8.50 to $9.50 in the Connellsville field, with Wise county and Pocahontas operators asking about 50 cents more on contract business. Very little New River furnace coke is to be had. Foundry coke for prompt shipment in all four fields ranges from $12 to $13, and on contract from $9.50 to $10.50. Foundry coke is much scarcer generally.

$13 Also Done in East

Philadelphia, June 26.—Sales of furnace coke for prompt shipment were made into this district late last week at $13, Connellsville. Although furnace operators continue to make efforts to cover for their requirements up to the end of the year, makers remain unwilling to accept orders so far ahead. Foundry coke has been sold during the week at $12.50, Connellsville, for delivery over the year beginning July 1.

Deliveries are Disappointing

St. Louis, June 25.—Supplies of coke arriving in this market and the surrounding district are considerably under requirements. The demand continues urgent. Certain plants are threatened with curtailment unless they are able to get more coke. Deliveries on contract show no improvement over the preceding week, and average under 50 per cent. Prices are very strong. The ovens report an enormous business, with virtually nothing offered for prompt shipment. Car supply continues the dominant factor. No increase of receipts here is shown. Connellsville and Virginia 72-hour foundry coke is quoted at $14.95 to $15.95, f. o. b. St. Louis, or East St. Louis, for prompt shipment or delivery over balance of 1917.

Southern Output at Top

Birmingham, Ala., June 26.—No recent sales of coke are reported in the Birmingham district though the market is as strong as ever. Pro-

ducers say they are not in position to take on any new business, regardless of price. Quotations range from $6 to $8 for furnace and from $10 to $12.50 for foundry coke. Present production is greater than ever before in this district. Unverified reports are current that the Sloss-Sheffield Steel & Iron Co. will shortly take steps looking to the construction of a large by-product coke oven plant. Deliveries of coke are being pushed in every direction. Inquiries still are numerous.

Shell Rounds Distributed

Government Directs Placing of Approximately 80,000 Tons Among Various Mills—Bar Iron and Hard Bars Up

New York, June 27.—Orders for the approximately 80,000 tons of large rounds for 3-inch shells have been distributed among six or eight different steel makers under government direction through the sub-committee of manufacturers at the agreed price of 3.75c, Pittsburgh. The Hydraulic Pressed Steel Co., Cleveland, which will produce forgings for finishing elsewhere, has been provided with 25,000 to 30,000 tons in this way. A New York state munition manufacturer is understood to have obtained 14,000 tons. The needs of other direct and sub-contractors have been supplied similarly.

Shrapnel Bars Placed

Chicago, June 26.—Distribution of about 80,000 tons of rounds for 3-inch shells has been made and the leading independent in Chicago has been given slightly less than 8000 tons. These will be forged by a Cleveland company and will be finished by T. A. Gillespie & Co., who have contracted for government munitions. In the same connection it is stated that Williams, White & Co., Moline, Ill., has a contract for shells for the government. Hard steel bars rerolled from rails are now quoted at 4.25c to 4.50c, Chicago mill. Demand is constant from manufacturers in general and the minimum quotation probably will disappear shortly. The high cost of rails is restraining makers from contracting beyond their supply and orders are somewhat difficult to place.

Hard Bar Sales Held Up

Cleveland, June 26.—Difficulty in obtaining rerolling rails and satisfactory scrap stock, is causing makers of reinforcing bars to make quotations more cautiously. Some of them decline to quote. The range of the market is from 3.75c to 4c, mill. An additional 1000 tons for the Firestone Tire & Rubber Co. buildings, Akron, probably will not be bought in view of prevailing conditions. Rivet prices still show considerable spread as some makers in this district are quoting unchanged at 4.90c to 5c for early shipment and third quarter contracts. The distribution of rivets for the government ship program still is incomplete.

Automobile Specifications Less

Pittsburgh, June 26.—Exceedingly heavy demand exists for bar steel and bar mill products. Builders of agricultural material are attempting to supplement contracts purchased some time ago, but without much success. Specifications from some sources, particularly the automobile trade, are said to be falling off slightly. Steel bars for future delivery are selling at 3.75c to 4.25c. Bar iron is held at 4.75c by Pittsburgh makers.

Eastern Bar Iron Rises Rapidly

Philadelphia, June 26.—The bar iron market continues to advance rapidly. One leading eastern maker now is quoting the following prices for prompt and third quarter: Refined iron bars, 4.50c, Pittsburgh; double refined, 4.90c to 5c; chain and engine bolt, 4.85c; ordinary staybolt iron, 5.25c. Other makers, however, continue to accept 4.25c and some business was done during the week at 4c. Higher prices on bar iron are due mainly to sensational advances in mill scrap. Demand for boat spikes continues of huge proportions. Makers are so sold ahead that in most cases they are refusing to quote on new business. Inquiries involve lots running up to 100 tons for shipyards in this locality. Boat spikes are quoted nominally at 5.25c to 5.50c, base mill.

Ask 5c for Bar Iron

Chicago, June 26.—One maker of bar iron in the Chicago district is asking 5c, Chicago, and does not desire further tonnage. The probability is that regular customers in need of added material could obtain bars at 4.50c, Chicago mill, though because of the high cost of scrap this is likely to be only under exceptional circumstances.

Hoop and Band Prices Soar

Pittsburgh, June 26.—The bone-dry amendment to the food bill, accepted by congress, presages a sharp decrease in demand for steel hoops for shipment to distilling interests. Several manufacturers now are refusing to sell hoops and bands at less than 6.25c and 6c, respectively. Demand is heavy and scarcely any material is available for nearby delivery.

Steel Chain Higher

Pittsburgh, June 26.—Several manufacturers of steel chain are quoting as high as 8c for ⅜-inch proof coil. Large quantities of material have been purchased recently by the naval department and pending inquiries from shipbuilding interests are extremely heavy.

Government Wants Shafting

Pittsburgh, June 26.—Manufacturers of cold-rolled steel shafting are furnishing heavy tonnages to the government for military purposes. Details of these orders, however, have not been announced. Shafting generally is quoted at 5 per cent off the list and above for future shipment.

Pipe Up $5

Foundries Again Raise Schedule—Pipe Prices Varied

New York, June 26.—Prices on cast iron pipe have been advanced another $5, effective June 25 to $65.50, New York, for 6-inch class B and to $68.50, New York, for 4-inch class B. Requirements originating in the country's war preparations are of growing importance in the pipe market. The recent buying of large tonnages of pipe for the United States army cantonments at Chattanooga, Tenn., and Columbia, S. C., has been followed by the award of 100 tons for the camp at Ayer, Mass., to the Warren Foundry & Machine Co. It is expected that requirements for the proposed camps at Wrightstown, N. J., and Yaphank, L. I., will materealize shortly. A large amount of business is coming out in the east in connection with extensions to industrial plants engaged in the manufacture of war supplies and for extensions to industrial towns. On 500 tons of 36-inch pipe for Boston, R. D. Wood & Co. were low at $59, delivered, for class C pipe and $58, for class D. On 438 tons of 4, 6 and 8-inch for Yonkers, N. Y., R. D. Wood & Co. were low at $61.99, delivered, for 4-inch and at $58.99 for 6 and 8-inch.

Steel Advance Not General

Pittsburgh, June 26.—The Wheeling Steel & Iron Co. and the La Belle Iron Works have distributed cards, showing advances in prices ranging

from $14 to $26 a ton on standard steel pipe. Quotations on oil country goods, including tubing, casing, drive and line pipe, were put up a few days ago $50 to $60 a ton. Several manufacturers have made no changes in quotations since May 1, and the National Tube Co. has not formally changed its prices since April 2. The bulk of the tonnage, however, is being sold at prevailing maximum quotations. The United States has sent out indefinite inquiries for water pipe for mains to serve cantonments. The United States Cast Iron Pipe & Foundry Co. is reported to have taken 7500 tons for military camps. It is likely that large quantities of wooden pipe also will be purchased for equipping these cantonments.

Cast Pipe Up $5

Chicago, June 26.—Makers of cast iron pipe have advanced quotations $5 per ton, effective June 25. This makes the present quotation $65.50, Chicago, for 6-inch or over and $68.50, Chicago, for 4-inch. Practically the only pending business is that expected from army cantonments which has not yet assumed sufficiently definite form to be figured. James B. Clow & Sons have been awarded 100 tons at Hammond, Ind.

War Sheet Needs Increase

Supplies for Outside Trade Gradually Become Shorter—Prices Generally Move Higher on Open Sales

Youngstown, O., June 26.—With government orders for sheets of all grades steadily increasing, the commercial consumer's chance is becoming less and less in the Mahoning valley. War orders in the valley, both from the navy and war departments and from sheet metal fabricators who are working on government orders, are in comparatively small tonnages, few if any running over 100 tons each, but the aggregate is fairly large and is growing gradually. The market grows steadily stronger except for price concessions on military work, running from 10 per cent and in some cases close to 20 per cent. Black sheets, No. 28 gage bessemer, are quoted at 8.75c to 9.25c; blue annealed, No. 10 gage bessemer, 8.25c to 8.75c; galvanized, No. 28 gage bessemer, 10.25c to 11c. For open-hearth sheets from $5 to $10 a ton more is paid.

It is now definitely understood that the sheet committee of the American Iron and Steel institute working in conjunction with the various committees and sub-committees of the council of national defense, will not make a large formal allotment of sheet orders. The inquiries largely are coming directly from the quartermasters' offices. The committee is co-operating and adjusting orders to mill conditions.

Government Needs Expanding

Philadelphia, June 26.—Prices on sheets have been advanced by eastern mills to 8.50c, Pittsburgh, or 8.659c, Philadelphia, for No. 10 blue annealed for delivery this year. Considerable business has been booked during the past week at the new price. Further tonnages have been taken at the reduced price to the government from companies manufacturing war supplies. Business of this character, however, is increasing to such an extent that the mills are not able to accept it so freely as before. The result is that a growing percentage for the single tonnages offered is being referred to the sub-committee on sheets for distribution among the various mills.

Sheet Prices Climb Upward

Pittsburgh, June 26.—Sheet manufacturers in all sections of the country now are devoting slightly less than 10 per cent of their capacity to direct and indirect requirements of the government. Purchases for military necessities may involve from 25 per cent to 40 per cent of the sheet mill capacity of the country before the end of the year. As long as steel is wanted to prosecute the war, requirements of the domestic trade will be subordinated to those of the nation. Small lots of material have been offered recently on the basis of 9c to 9.25c for black, 10.25c to 11.50c for galvanized and 8c to 8.50c for blue annealed products.

Supplies Becoming Scarcer

Chicago, June 26.—Makers of steel sheets have practically retired from the market in this district. With the increasing scarcity which has been evident for some weeks, and the pending government requirements for camp stoves and other devices further sales to the outside trade are deemed unwise. As high as 9.19c, Chicago, is being quoted by some makers on No. 28 gage black and No. 10 gage blue annealed, while 11.19c, Chicago, has been quoted on No. 28 gage galvanized. Probably somewhat lower prices could be obtained on attractive specifications for small tonnages. Some of the recent government orders are understood to have been contracted for on the basis of 6.50c on blue annealed.

Forging Steel is Placed

For Various War Requirements Including Munitions, Guns, Aeroplane Shafts, etc.—Inquiries for Government Are Numerous

Pittsburgh, June 26.—Companies which have received contracts for shells from the United States government are reported to have distributed orders for huge quantities of forging material. While it is known that manufacturers in this district have been called upon for a large portion of the shellmaking material, yet details of these orders have not been announced. They were distributed by the government under the direction of a sub-committee of the American Iron and Steel institute. Forging billets for domestic shipment are quoted at $115 to $125, mill. Sheet bars are commanding $105 to $110 and billets, $95 to $100. Anxious consumers have deserted the open market, apparently because of inability to obtain additional tonnages. Demand for wire rods, quoted at $95 to $100, is extremely heavy. Muck bar nominally is quoted at about $80, Pittsburgh.

Aeroplane Steel is Wanted

Cleveland, June 26.—Steel for crank shafts for aeroplanes, a line of production which a number of the forge shops are taking up, is beginning to be sought from the mills in increasing quantities. In the same connection, a number of the leading automobile builders in this and surrounding territory are interesting themselves in the production of aeroplane motors. A local company which has taken an order for 3-inch gun forgings, has arranged for the steel required, amounting to 5000 or 6000 tons. Sheet bar makers in this territory have made no recent quotations, but the market appears to be not less than $110 to $115 mill. Various companies who have been marketing their discards and crops, have ceased to do so and are using this material themselves because of the high cost of pig iron.

The Remington Arms Co., Ilion, N. Y., announces having taken a large order from the United States government for rifles. It is understood that at least 1,000,000 rifles will be made at the Ilion plant.

War Needs in Shapes Grow

Difficulty to Get Tonnage for Private Work Increasing—Fabricating Capacity to be Taken Up Far Ahead

Philadelphia, June 25.—Contracts for office buildings, hotels, apartment houses and similar structures have been dwindling to such an extent that practically all structural steel projects now involve extensions to government navy yards and arsenals, to manufacturing establishments, shipyards, etc. In general, the demand for structural steel more and more is arising out of war preparations. The impression rapidly is growing that structural steel other than for war purposes, direct or indirect, will be more difficult to obtain, particularly in view of the likelihood that a large percentage of the shape mill output will be called for in the near future for the government steel ship program. In fact, many fabricators already will accept no bookings which will prevent their participating in the shipbuilding work. The city of Philadelphia will open bids July 10 for five elevated railroad stations, involving a small amount. This project forms a portion of the projected transit system for which bids recently were taken on large tonnages of steel. The minimum in this district on plain shapes continues 4.50c, Pittsburgh, for delivery at mills' convenience. Considerable tonnage for specification over third quarter has been booked at 6c, Pittsburgh. Several thousand tons of ship shapes have been sold for export at 8c, Pittsburgh, for the first half of 1918.

Fabricated Capacity to Be Taxed

Pittsburgh, June 26.—Plans of the government to build ships and munition plants on a large scale indicate that fabricators will be taxed to their capacity for 24 months or longer. On account of the prevailing high prices of material, it is not likely that much private work can be undertaken, although it is not believed that the war solely is responsible for the lull in activity along this line. Rolling mills in all sections of the country are increasing capacity and many new industrial projects are under consideration. The Republic Iron & Steel Co., Youngstown, has awarded the McClintic-Marshall Co. 2500 tons for extensions to its open-hearth steel works. Structural shapes are quoted at 4c to 6c, depending upon the delivery.

Work Lags in West

Chicago, June 26.—Continued inactivity marks the structural market and building is becoming markedly less on account of present high prices. Scarcely a commercial structure is now being undertaken and even industrial extensions are somewhat less active than formerly. One eastern independent, which has been able to sell shapes recently, has obtained 6.19c, Chicago, on such small lots as it could give delivery. Some tendency is noted toward reinforced concrete as a cheaper material. A recent instance of this kind is the decision to build of concrete a manufacturing plant for the Linde Air Products Co., at Seattle.

CONTRACTS PLACED.

Bridges for Pennsylvania railroad, 1500 tons, to Bethlehem Steel Bridge Corp.

Fire house, Jersey City, N. J., 150 tons, to Fagan Iron Works.

Building for naval station at Newport, 300 tons, to American Bridge Co.

Extension to open hearth buildings of the Republic Iron & Steel Co., Youngstown, 2500 tons, to the McClintic-Marshall Co.

CONTRACTS PENDING.

Bridges for Pennsylvania railroad, 500 tons, bids being taken.

Elevated railroad stations for city of Philadelphia, 150 tons, bids due July 10.

Extension to erecting shop at Washington navy yard, bids being taken.

Public library, Philadelphia, 2500 tons, revised bids being taken.

Culver rapid transit extension, Brooklyn, 3800 tons, bids to be opened July 5 by Public Service Corporation of New York.

Boat Plates Sell at 11c

Export Tonnage Goes at That Figure For Next Year—Mills Cut Down Orders of Consumers

Philadelphia, June 25.—Placing of contracts for third quarter specification comprises most of the current business in the plate market. On these the minimum prices continue 10.159c, base, Philadelphia, for tank plates and 11.159c to 12.659c, base for Lloyd's ship plates. The tonnages in each case are kept down as much as possible. Such contracts are being accepted generally only from regular customers. Unsatisfied demand shows no let-up and many consumers in vain are imploring the mills to accept their orders; one leading eastern mill turned down an attractive specification for 5000 tons, another for 2400 tons and a number embracing 1000 tons or less each. Inquiries for export continue to come out in volume but only one of these, so far as known, was placed. This was an unusually urgent requirement involving about 5000 tons of boat steel which went at 11c, Pittsburgh, for shipment over the first half of 1918.

Mills Pushed to Limit

Pittsburgh, June 26.—Plate mill capacity is being taxed to the extreme limit to meet requirements of the government and private shipbuilders. Shipbuilding programs, now under consideration, call for tremendous tonnages of ship material in the aggregate, but it is apparent that the industrial resources of this country are sufficient to meet almost any demand. Steel plates are selling at as high as 11c for prompt shipment, and no mills in this district are quoting less than 8c for delivery at their convenience. The 4.50c price of the Carnegie Steel Co. is regarded as nominal.

Chicago Market at 10c

Chicago, June 26.—Continued scarcity and strong demand for steel plates have placed the quotation at about 10c, mill. A local maker declined an offer of 9.50c on 1400 tons of tank quality because the material was not available. An export inquiry for 12,000 tons has been current. An eastern independent has been quoting 8c to 10c, Pittsburgh, and an Ohio independent has taken some tonnage at 10c, mill, for delivery in about six months. This maker is now also out of the market. Added tonnages for government ship work are expected to go out shortly.

Capacity Sold

And Tin-plate Makers Have Little to Offer—Old Mill Starts

Pittsburgh, June 26.—The American Steel Co., which controls the Waynesburg tin plate plant of four mills, started operations June 25. The plant had been idle for many years. It is reported that tin plate for early shipment has been sold as high as $15 a box, and that figure has been paid for export. Generally tin plate mills have no additional tonnages to offer for shipment this year. They continue to give preferential service to packers working on government contracts.

Fever is Leaving Scrap

Price Fluctuations Less Violent But Market Exceedingly Strong and Some Districts Report Further Advances

Chicago, June 25.—After a spectacular career which carried the general level of iron and steel scrap quotations beyond all records or expectations, a pause has followed. This is not regarded as an indication of weakness or a recession. Prices had attained a level which put a limit to the financing ability of many dealers, who were forced to curtail operations temporarily. Consumers still are seeking materials and it is not coming from the usual sources in sufficient volume. After a readjustment, it is believed, a further advance will follow, as a shortage exists. A number of railroad lists are now current, but most of them carry small tonnages, an indication that this source will not yield heavily to meet the existing demand. The Rock Island railroad offers 2000 tons, the Soo Line railroad 570 tons, the Kansas City Terminal railroad 200 tons, the Wabash railroad 300 tons, the Monon railroad 400 tons, the Ann Arbor railroad 75 tons, and George W. Jennings & Co., 500 tons.

Clean Up Steel Supplies

New York, June 26.—Much of the current activity in old material continues to be centered in heavy melting steel. Although this grade is neglected by eastern consumers dealers in the Pittsburgh district continue to take all that is available; $42.75, delivered Pittsburgh, has been paid freely here and as high as $44, delivered, has been done on a considerable tonnage. The demand from Pittsburgh appears unsatiable. At least two eastern Pennsylvania consumers of heavy melting steel are expected in the market for large tonnages soon. The market is pretty well cleaned up as a result of the recent Pittsburgh buying. All the rolling mill grades have been taken actively and much inquiry is unsatisfied. Foundry grades have been fairly active especially machinery cast and stove plate.

Advances Continue in East

Philadelphia, June 25.—Sales of steel scrap to Pittsburgh dealers again furnished a large share of the activity in the old material market in this district during the past week. A large tonnage in the aggregate was involved and the prices paid ranged up to $45, delivered Pittsburgh. Higher offers have been made since. Eastern consumers of heavy melting steel continue to feel out the market, but are not willing to pay the prices asked. Sales of rolling mill grades during the week were active, involving numerous lots of several hundred tons each. Demand for foundry grades is slow comparatively. Even in these grades, however, demand is sufficient to take up all offerings. Prices on all descriptions have advanced and now range from $1 to $13 higher than a week ago. The most sensational advances of late have been on rerolling rails, heavy melting steel, low phosphorus steel, iron and steel axles, steel shafting, wrought scrap and heavy cast.

Scramble Continues at Pittsburgh

Pittsburgh, June 26.—Iron and steel scrap merchants have been buying heavy tonnages to apply against contracts taken some time ago. Several dealers are reported to have offered as high as $48 a ton for heavy melting steel of good quality. In a transaction between dealers, $47.50 was paid. A scarcity of scrap is said to exist. Rerolling rails are being purchased in rather large quantities at as high as $55, delivered. No. 1 wrought scrap has advanced from $47 to $50 and bundled sheets are up $1 a ton. Low phosphorus steel scrap is reported to have sold at as high as $60 for billet and bloom crops. Machine shop turnings and borings are quoted at $24 to $26.

Producers Willing to Speculate

Cleveland, June 25.—Cleveland scrap producers are showing willingness to sell for the future. One company offered its output of machine shop turnings for the remainder of the year, about a dozen cars, at from $21 to $23, which is from $2 to $4 above the present market. Some of the dealers declare that the market, although strong, is becoming spotty, and that a reaction is due. While there are quite a few offerings of small to fair-sized tonnages by producers, there is little important trading of any sort. Consumers are not buying heavily, and dealers are sitting tight and doing no more trading than they are obliged to do to cover short sales. Rails continue scarce. Heavy melting steel is quoted at $41 to $43 per gross ton; machine shop turnings, $19 to $20 per net ton; cast borings, $21 to $22 per net ton.

Cincinnati Market Slackens

Cincinnati, June 25.—Scrap prices are not as strong as they were last week and the demand has slackened considerably. This is said to be due to the fact that many melters who consume large quantities have bought freely during the past few weeks, and have covered for nearby requirements. Should pig iron continue to advance, as at present, it is the general opinion that the present weakness will be only temporary.

Crest is Reached

St. Louis, June 25.—A steadier tone prevailed in the market for scrap throughout the past week. The feverish advance of the past two months was checked, and certain brokers expressed the belief that the crest has been attained. Dealers are hesitating as to buying large tonnages at current prices. Any change in the market, it is thought, must be downward. On the other hand, a big contingent in the market takes a very bullish attitude. With pig iron so strong and scarce, and the consumptive demand greatest in history, it is maintained that old material prices are not likely to react very far. While quoted prices have been reached in recent sales, most quotations now are nominal. The only railroad offerings before the market this week were: Chicago, Burlington & Quincy railroad, 2000 tons; Nashville, Chattanooga & St. Louis railroad, 500 tons; and a small list from the St. Louis & San Francisco railroad.

Southern Activity is Continued

Birmingham, June 26.—Continued activity is noted in the scrap market in southern territory and dealers are making every effort to get hold of stock with which to meet the demand. Supplies are scarce, however. Inquiries still are being received from other centers and offers are numerous. Several advances again are noted this week. Old steel rails went up $4 to $30 and $31, No. 1 wrought to $31 and $32, heavy melting steel to $24 and $26, car wheels to $27 and $28, tramcar wheels to $24 and $26, shop turnings to $12 and $13. Dealers are not anxious to sell.

Buys Brass Mills

The American Brass Co., Waterbury, Conn., has purchased the Buffalo Copper & Brass Rolling Mills, Buffalo, N. Y., and will take possession July 2. The plant will be operated as the Buffalo Copper & Brass Mill branch of the American Brass Co., under general supervision from the main office. The present management will be continued.

The National Castings Co., Marietta, Pa., will commence operations in its new foundry on July 2. Gray iron and semisteel castings will be produced.

Again Sell English Ferro

Export Metal Reappears in Market and Sold at $375, Seaboard —Prompt Around $450—Ferrosilicon Active

New York, June 26.—Sales of 80 per cent English ferromanganese again are being made in this country for the first time in several months. Several hundred tons have been sold for first half at $375, tidewater. This business has been taken subject to the granting of export licenses. Further sales of domestic metal have been made at $375, delivered, for the first half. A few more carloads of prompt have been sold around $450, and some business has gone higher. A last quarter sale of domestic was made at $450. One seller in quoting is directing customers' attention to the scarcity and is suggesting that no ferromanganese be bought where spiegeleisen will serve instead. Licenses for exporting an additional 500 tons of English metal to this country have been granted by the British ministry. Since the recent sinking of the SOUTHLAND with 1000 tons aboard, another vessel with about 500 tons for this country has been sunk.

More activity has characterized 50 per cent ferrosilicon during the past week than for sometime. Good sales of this metal have been made to eastern consumers at $130, delivered, for the first half of 1918. Higher prices again have been done on prompt and fair-sized sales are reported both at $275 and $300. Fair lots for the last half have been booked at $250. Inquiry is good and includes several 200 to 500-ton lots.

Quotations of $105, furnace, on Jackson county 11 per cent bessemer ferrosilicon for this year have been made. The Bethlehem Steel Co. is expected to close shortly on approximately 2000 tons of 11 per cent.

Spiegeleisen has been active and considerable prompt went at $85 and $87.50, furnace. Sales for the rest of the year have been made at $82 to $85, furnace. One interest now is quoting $90 both on this and next year. Spiegeleisen for first half last week was sold at $75, furnace.

Advance Ferro to $450

Pittsburgh, June 26.—Sellers of ferromanganese have advanced prices to $450 for delivery the remainder of this year and $425 for shipment the first quarter of 1918. No large sales have been made recently in the open market. Bessemer ferrosilicon is being sold on the basis of $90, furnace, for 10 per cent. Twenty per cent spiegeleisen is quoted at $80 to $85.

Chicago Ferro at $450

Chicago, June 27.—Ferromanganese from the local stack is becoming increasingly scarce and the quotation is held firm at $450, furnace.

Nails For Camps

Being Closed by Government at Reported Price of $3.20

Pittsburgh, June 26.—Distribution of 50,000 kegs or more of nails for various cantonments is being made by the government and price is understood to be $3.20 per keg. One maker in this district took 2500 kegs for an Ohio cantonment. Independent manufacturers of wire products who advanced quotations $10 a ton a week ago, have experienced no difficulty in selling material on the basis of $4 per keg for nails, and reports of sales at as high as $4.10 per keg are heard. Manufacturers, as previously explained in these columns, have not advanced their quotations, but the bulk of the tonnage being sold is commanding prevailing maximum prices. The American Steel & Wire Co. has made no change in its quotation since March 5, when it effected an advance of $4 a ton to $3.20 per keg for nails.

Buy 1919 Track Supplies

Western Roads Close 100,000 Kegs of Spikes at 4.25c, Chicago —Colorado Mill Quotes $45 on Standard Rails

Chicago, June 26.—Although no standard steel rails are being sold by the Chicago maker at present, an occasional insight into the rail prices is obtained. It has come to light in this market that a Colorado maker has quoted $45 on standard sections. Recently a lot of 150 tons of seconds was sold at $60 per ton. These are new rails failing to pass inspection. A recent inquiry by the Missouri, Kansas & Texas railroad on 30,000 tons for 1919 delivery has not been satisfied. It is stated that about 9000 tons of rails bought by a western railroad from a Canadian mill two years ago were undelivered when war conditions arose and have not been received. Light section rails have been advanced $5 per ton to $65, Chicago, on excellent demand.

A recent sale of 100,000 kegs of railroad spikes for 1919 delivery was made at 4.25c, Chicago. These spikes are to accompany rails already contracted for that year. Rail bookings for 1919 by the local maker are placed at about 275,000 tons. Splice bars are quoted at 3.25c, Chicago, and track bolts at 5.25c, Chicago.

Railroad car buying continues to lag. The plan of the government to buy 100,000 cars for general use is a bar to general inquiry. The only exception is an inquiry by the Grand Trunk railroad for 1000 box cars.

Spike Demand Lessens

New York, June 27.—Demand for railroad spikes is rather quiet in the east and the price is unchanged at 4.50c, base mill, for ½-inch and larger spikes. Several additional orders for open-hearth rails involving up to 200 or 300 tons each, have been placed in the east at $70, mill.

The American Locomotive Co. has taken an order from the Detroit & Toledo Shore Line for two switching locomotives.

The New York, New Haven & Hartford railroad will strengthen or rebuild 88 bridges on its lines this summer, which will require 14,623 tons of structural steel, much of which was ordered months ago.

Light Rails Very Active

Pittsburgh, June 26.—A very active demand for light rails has developed. Sales by the local makers this week totaled several thousand tons and inquiries several times as much. Quotations now are more restricted. Some eastern buyers have been coming west and have been picking up odd tonnages from the warehouses at high prices. The Carnegie Steel Co. is not yet ready to offer standard rails for 1919 delivery. The Pennsylvania railroad is closing for 8000 steel wheels for cars to be built at Altoona.

Buys Iron Ore

New York, June 26. — The Reading Iron Co. has purchased about 50,000 tons of old range nonbessemer iron ore at a price understood to be between $5.50 and $6.25 a ton at lower lake ports. When the ore market opened last fall, this grade sold at $5.20.

The Indiana Boiler Manufacturers association, through Michael H. Broderick, Muncie, Ind., has secured a contract for 1200 boilers for government war purposes. It is planned to divide the contract among 12 factories.

Water Shipment

Of Southern Iron to North Being Tried—Trucks Are Used

Birmingham, Ala., June 26. (By wire.)—Several of the furnace companies of the Birmingham district are making deliveries of pig iron to nearby consumers with motor trucks. Iron from the Vanderbilt furnaces of the Woodward company are handled in trucks to melters in the immediate district, while the Sloss-Sheffield, the Republic and other companies are also making small lots deliveries by the same methods. Investigations as to a water course shipment of pig iron from Alabama to the St. Louis and Chicago markets have not brought any extensive developments. The Sloss-Sheffield Steel & Iron Co. shipped some iron from Florence-Sheffield via the Tennessee river to a point in Illinois on the Mississippi river and another company has been considering the plan to ship iron via the Warrior river to the Mississippi and thence up to points in Missouri and Illinois. No final arrangements have been made.

Pig iron prices have taken another boost and sales of both foundry and basic are reported $1 to $4 higher. No. 2 foundry has been done at $45, while a heavy tonnage of basic was sold to the St. Louis district for six months delivery beginning Oct. 1, at $50.

Foundrymen Elect

The Pittsburgh Foundrymen's association has elected officers for the year as follows: President, L. A. Way, Duquesne Steel Foundry Co.; vice president, Lloyd Uhler, Union Steel Casting Co.; secretary, Frank H. Zimmers, National Steel Casting Co.; treasurer, W. J. Brant, W. J. Brant & Co.; executive board: C. K. Gale, Pressed Steel Car Co.; F. H. Clay, Allegheny Steel Co.; A. J. Hartman, United Engineering & Foundry Co.; J. Roy Tanner, Pittsburgh Valve Foundry & Construction Co.

Construction Work Gains

Contracts awarded during the January-June period for building and engineering operations in states north of the Ohio and east of the Missouri rivers, according to the F. W. Dodge Co. reports, totaled $624,861,000 for 1917, compared with $451,101,500 for 1916 and $321,241,100 for 1915. Statistics of the same class of operations in western Pennsylvania, West Virginia and Ohio give the value of contracts awarded during the January-June interval as $80,156,000 for 1917, $58,521,000 for 1916 and $47,804,400 for 1915.

Alloy Plant

Will be Established in Old Chattanooga Steel Works

Chattanooga, June 26.—The Southern Ferro-Alloys Co., has begun remodeling the old Southern Steel plant here and expects to have it operating by fall. Products to be manufactured include 50 per cent ferrosilicon. It is planned to expand the line of products later to include ferrochrome and ferromolybdenum. Three electric furnaces will be installed. Contract for the electric power has been taken by the Tennessee Power Co.

The new company is capitalized at $210,000 under Tennessee charter. Its officers include: Chairman, Eugene P. Clark; president, P. J. Kreusi; vice president and treasurer, N. Thayer Montague; vice president, G. L. Davidson, and secretary, Theodore L. Montague. With the exception of Mr. Clark, who is from Chicago, and Mr. Davidson, from Michigan, all the officers are Chattanoogans.

Option Machinery Plant

Options have been secured by Chicago interests on a majority of the common stock of the Long & Alstatter Co., Hamilton, O., manufacturer of power punches and shears. Stock having a par value of $135,000 and a present value of approximately $200,000, is involved in the deal. This company, founded in 1855 and incorporated in 1878, has been doing an annual business of $500,000.

Enlarges Shop Capacity

Additions, either completed or in course of construction at the plant of the Ferguson Steel & Iron Co., Buffalo, N. Y., have increased the manufacturing facilities of that company tenfold. The fabricating shop, now almost completed is 130 x 760 feet and contains 850 tons of steel. This shop in conjunction with the warehouse extends a distance of 1300 feet. A 2-story addition, 30 x 40 feet for the drafting department and an addition 40 x 50 feet, to the main office building are being built.

The Economy Baler Co., Ann Arbor, Mich., is building a machine shop addition 70 x 100 feet and an addition to its assemling plant to increase its output of a new type of scrap sheet metal baler recently placed upon the market. These balers compress scrap metals into a billet for shipping, or for use in a crucible or charging box.

Further Rises

Prices in Various Districts—Sheets Very Strong

New York, June 26.—Demand for iron and steel out of warehouse continues brisk in this district. The heaviest call is for plates, while structural shapes and bars also are exceptionally active. The present level of prices is, plates, 9c; shapes, 5.25c; bars and small shapes, 5c; reinforcing bars, 5.10c; iron bars, 4.75c; No. 10 blue annealed sheets, 9.50c; No. 28 black sheets, 10c; No. 28 galvanized sheets, 12c.

Sheets Up Sharply

Cleveland, June 26.—Sheets from store have again advanced. The week's changes represent $15 up on No. 28 black, $5 on No. 10 blue annealed and $10 on No. 28 galvanized. Other warehouse products are unchanged, but there is a considerable spread between some of the leading interests.

Chicago Stores Advance Sheets

Chicago, June 25.—Store prices on plates, shapes and bars are unchanged. The only changes recently have been on steel sheets which are now quoted at 9.50c for No. 28 gage black and No. 10 gage blue annealed. Galvanized sheets remain firm at 11c for No. 28 gage. Light rails from store are being held at $72 per ton for 25 to 45-pound weights.

Use Hardening Process

The Findlay Steel Casting Co., Findlay, O., occupants of the former factory of the Grant Motor Car Corp. will exploit a metal hardening process invented by Dr. C. H. Hage. Equipment, inclusive of several furnaces having a daily capacity of 5 tons and 2 electric furnaces having a capacity of 15 tons have been contracted for. H. A. Deiters is the engineer in charge.

To Build Aircraft

The Lawson Aircraft Co., organized several months ago by Green Bay, Wis., capital under the direction of Alfred Lawson, an expert builder and operator of flying machines, has completed the work of equipping the first unit of its new plant. The company has leased five buildings, consisting of three former machine shops and two woodworking shops, but will use only one immediately.

The Cambria Steel Co., Johnstown, Pa., has put into operation No. 10 blast furnace, a duplicate of Nos. 7, 8 and 9 stacks. The stack has a rated capacity of 500 tons a day.

Ten Steel Ships

Added to Goethals Contract List—104 Complete Vessels Placed

Washington, June 26.—Ten complete steel cargo steamers were awarded during the past week to the Moore & Scott Iron Works, San Francisco, by the emergency fleet corporation of the United States shipping board. The first and second of these ships are to be delivered in February, 1918, the third in March, the fourth and fifth in June, the sixth in August, the seventh and eighth in October, and the ninth and tenth in November. The corporation also made its first contract for marine engines, awarding 12 of the vertical triple-expansion type to the Ellicott Machine Corporation, Baltimore.

Awards for wooden hulls and complete wooden ships were made as follows: Four wooden hulls to Portland Ceiling Co., Portland, Me.; deliveries Feb. 1, 1918, March 15, May 1, and June 15; 12 wooden hulls to Universal Shipbuilding Co., works at Houston ship canal, Harris county, Texas; first and second seven months after completion of ways, third and fourth eight months, fifth and sixth nine months, seventh and eighth 10 months, ninth and tenth 11 months, and eleventh and twelfth 12 months after completion of ways; four wooden hulls to McBride & Law, Beaumont, Tex.; first on or before March 1, 1918; second on April 1, third on May 1, and fourth on June 1; four complete wooden ships to Newcomb Life Boat Co., Hampton, Va.; first by Jan. 15, 1918, and one steamer every 60 days thereafter.

A summary of awards made to date for the fleet corporation follows: Total number contracts for ships and hulls executed, 22; total number ships and hulls contracted for, 176, including 36 complete steel ships, 32 complete composite ships, 34 complete wooden ships, and 72 wooden hulls.

Completing Coke Plant

Work on the by-product coke ovens at the plant of the Chattanooga Gas & Coal Products Co., Chattanooga, Tenn., is progressing rapidly under a contract held by the Semet-Solvay Co., New York. The plant will have a capacity of 10,000 tons of coke and 4,000,000 cubic feet of gas a month; of the latter about one-half will be sold.

Will Build Coke Plant

The Donner-Union Coke Corp., recently incorporated in New York and whose coke output will be equally divided betwen the Donner Steel Co., Inc., Buffalo, and the Buffalo-Union Furnace Co., Buffalo, has elected officers. They are: President, W. H. Donner, vice president, F. B. Baird; secretary, W. B. Enck, and treasurer, Harry Yates. The directors include the officers and Robert Donner, C. A. Collins and F. C. Slee. The company will build a by-product coke plant, of 2000 tons daily capacity, at Buffalo, on a site adjoining the Donner Steel plant which will take the gas output.

Food Shortage

Threatened Unless Implement Makers Get Material, Says Brantingham

Chicago, June 25.—Charles S. Brantingham of the Emerson Brantingham Co., Rockford, Ill., chairman of the executive committee of the National Implement and Vehicle Manufacturers association, sounds a warning that special attention must be given the implement manufacturing trade to prevent curtailment of crop production in 1918.

In a recent statement Mr. Brantingham says: "The truth is that unless prompt action is taken by the government, our country is headed straight toward the selfsame mistakes that have resulted in compelling our allies to come to us to save them from famine. We are now confronted by shortages of raw material and factory labor that will begin to be manifest in shortages of certain lines of farm machinery this fall and will result in serious shortages in many vital lines next year. These are the measures that we declare to be vital to the feeding of this nation and its allies next year:

"That the manufacture of farm materials, be given equal preference as to supplies of necessary raw materials, with the making of war munitions.

"That service to the country in farm machinery factories be considered as of equal importance with service in munition-making plants, government or private.

"That labor on the farms be considered as of equal importance with the production of war munitions.

"That the raw materials for farming machinery and the finished goods be given equal preference by the transportation agencies with munitions of war.

"These measures must be taken immediately to be effective. Delays in action will be as disastrous as failure to act at all."

More Steel For Republic

Extensive improvements are to be made at the plant of the Republic Iron & Steel Co., Youngstown, O. Two 80-ton open-hearth furnaces and two soaking pits with auxiliary equipment, are to be completed early in 1918, enabling the company to produce 1,400,000 tons of steel annually.

Steel Scarcity

Holds Up Placing of Government Car Order—Not Dismantling Locomotives

Washington, June 26.—Inability to get steel is assigned as the chief reason for the government withholding its plan to purchase 100,000 freight cars and to lease them to the railroads. S. M. Vauclain, chairman of the co-operative committee on cars, advisory commission, council of national defense, said that the railroads now have contracts pending for 75,000 cars which have not been delivered owing to the steel situation. At the offices of the executive committee of the special committee on national defense a similar explanation was made. Mr. Vauclain also stated that nothing has been done with regard to arranging prices for plates and other steel requirements for government cars.

George Hodges, assistant to the general chairman of the special railroad committee on national defense, discredits the report that a large number of old locomotives, especially in the south, are being dismantled and shipped to France to be rebuilt for war service. So far, he pointed out, a canvass of clearances indicates there would be none available for shipment. The report that a number of Pullman cars are being stripped to make them suitable for the transportation of munitions also was said to be inaccurate. This type of car, however, is being converted into tourist cars for the transportation of troops.

Ordnance Awards Not to Be Made Public

Washington, June 26.—Because of war conditions the war department has decided not to make public the awards of ordnance contracts. Information as to the size of contracts is withheld because of its value to the enemy, and the names of firms working on government orders will not be given out because it is believed best not to draw attention toward them.

Brigadier General Crozier, chief of ordnance, has issued the following statement: "The war department is having no difficulty placing contracts with American firms for rifles and pistols and for rifle and pistol ammunition, and has every reason to feel confident that the contracts will be executed expeditiously and well."

Park & Williams, Real Estate Trust building, Philadelphia, have reorganized as Park & Williams, Inc. The company has moved from the 15th floor into a suite of offices on the 17th floor at the same address.

Boilermakers Pledge Aid to Nation

Manufacturers at Pittsburgh Convention Agree to Handle Government Work —Large Number of Marine-Type Boilers Will Be Needed to Outfit New Merchant Ships

THE part which the boiler industry must play in aiding the government to prosecute the war successfully engaged the closest attention of the members of the American Boiler Manufacturers' association at their Pittsburgh convention this week. The meeting was the twenty-ninth annual convention held by the society.

M. H. Broderick, Broderick Mfg. Co., Muncie, Ind., president of the association, sounded this keynote in his opening address. He pointed out briefly the demands which the boiler industry will face in properly equipping the great number of merchant vessels to be built by the government. He urged the boilermakers of the country to prepare at this time to handle marine work.

Asks Aid for Government

At the opening session, held at the William Penn hotel on Monday, June 25, Thomas E. Durban, Erie, Pa., emphatically backed up the position of Mr. Broderick that the boiler manufacturers must hold themselves ready to give assistance to the government. "Specifications will soon be out," said Mr. Durban, "which will put every boilermaker in the country in a position to build marine-type boilers. Formerly, this type of boiler was shrouded in mystery. Those days have passed, however, and I look forward to the time when American-made marine boilers will be used all over the world. This war has developed or will develop our boiler art further than it has ever progressed before."

Mr. Durban emphasized the necessity of the boiler manufacturers strengthening their organization, not only to assist the government, but to build up the industry itself. He recounted his experience at Washington when officials there had appealed to him for definite information regarding the boiler industry of the country, particularly the present and prospective capacity for taking care of federal work. "Through their various trade associations," he stated, "practically all other industries were able to lay before the government definite and valuable statistics regarding the joint capacities of their plants. The boiler industry, however, had no such information to offer." Mr. Durban pointed out the need for such information in order that the boiler manufacturers could better protect their own interests.

Mr. Durban also suggested changes in the practices now followed by boiler manufacturers. Among other things, he suggested that the statistics which the government wanted be compiled immediately; that a standard cost system be introduced; that a standard form of contract be drawn up which could be compressed onto a postal card, instead of filling pages; that boiler manufacturers drop that part of the installation work which properly should be taken care of by a contractor; that uniform terms of payment be insisted upon.

The delegates unanimously adopted a resolution, pledging the support of the association and its members to the government in enabling it to meet any emergency demand caused by the war.

E. S. Sweet, assistant secretary of commerce, Washington, discussed "Industrial Co-operation in the War". "Success in this war," he said, "is not a question of soldiers, but one of industry. This war will be won in this country. We are building more ships now than ever before. Many of them are being sunk, but we have the steel, wood, capital and labor and shall keep on building ships. At the end of the war we shall have more ships than ever before and for the first time in years shall have a real merchant marine."

Mr. Sweet pointed out to the boiler manufacturers the distinction between the work now being carried on by the federal trade commission and the department of commerce. He compared the trade commission to a traffic policeman, while the department of commerce, through the bureau of foreign and domestic commerce, confined itself largely to promotive work. He outlined his hope that after the war an international trade commission would be organized which would labor to prevent trade jealousies.

George A. Luck, representing the Massachusetts board of boiler rules, discussed "Steam Boiler Regulation in Massachusetts". C. V. Kellogg, of Kellogg & McKay, Chicago, spoke on "By-Products of the War". S. F. Teeter, chief engineer, Hartford Steam Boiler Inspection & Insurance Co., presented a paper on "The Boiler Inspector and His Relations to the Purchaser and Manufacturer". D. M. Medcalf, chief inspector, Toronto, Ont., gave a historical narrative of the "Boilermaking Industry in Canada and the Effects of the War Upon It". W. H. S. Bateman, Philadelphia, representing the Champion Rivet Co., discussed "The Sequel to the Indifference of Boiler Manufacturers Toward any Improvement Which Would Result in Their Commercial Advancement".

Demand for Marine Boilers

Mr. Medcalf told how the war has speeded up the boiler industry of Canada, despite the great scarcity of steel and labor at the present time. "The biggest demand now is for marine boilers," he said, "and the supply falls far below the demand."

The nominating committee was headed by A. J. Schaaf, Pittsburgh Coal Co., Pittsburgh; B. R. Cogswell, Oil Well Supply Co., Oswego, N. Y., and R. E. Ashley, Muskegon Boiler Works, Muskegon, Mich. The auditing committee was headed by J. Don Smith, Valk & Murdoch Iron Works, Charleston, S. C.; George Riley, National Tube Co., McKeesport, Pa., and Cliff Tudor, Tudor Boiler Works, Cincinnati.

New Officers A. B. M. A.

The following officers were elected to head the American Boiler Manufacturers' Association for the next year. With the exception of E. R. Fish, who succeeds I. Harter Jr., Babcock & Wilcox Co., all the officers were re-elected:

PRESIDENT

M. H. Broderick, Broderick Mfg. Co., Muncie, Ind.

VICE PRESIDENT

C. V. Kellogg, Kellogg & McKay, Chicago

SECRETARY AND TREASURER

H. N. Covell, Lidgerwood Mfg. Co., Brooklyn, N. Y.

EXECUTIVE COMMITTEE

W. C. Connelly, D. Connelly Boiler Co., Cleveland.
G. S. Barnum, The Bigelow Co., New Haven, Conn.
E. C. Fisher, Wickes Boiler Co., Saginaw, Mich.
E. R. Fish, Heine Safety Boiler Co., St. Louis.
Louis Mohr, John Mohr & Sons Co., Chicago.

Steel Costs

Will Be Determined by Commission Under Presidential Order

Washington, June 27. (By wire.)—As a result of the controversy begun by Chairman Denman, of the shipping board, as to prices of steel for the merchant shipbuilding program, it has been officially announced that President Wilson has ordered the federal trade commission to begin at once an investigation of the cost of producing steel and lumber. It is believed that the investigation will cover the entire steel industry, including the cost of finished products and alloys. President Wilson discussed the matter for more than an hour with the commission last Saturday in regard to its activities in obtaining costs on various commodities. It is apparent that the President hopes to fix steel prices as a result of the investigation. These may be made applicable to individual as well as to government requirements.

Iron Demands

Of Government and Allies Placed at 75,000 to 100,000 Tons

Pittsburgh, June 27. (By wire.)—War requirements of the government rapidly are becoming more clearly defined. Mill managers knowing how much capacity they will devote to the prosecution of the war are beginning to again consider needs of domestic consumers.

It is likely that a huge block of bessemer and foundry pig iron involving 75,000 to 100,000 tons will be distributed at an early date for the government and its allies.

Immediately after the distribution of 50,000 kegs of nails an independent manufacturer advanced his quotation generally for domestic delivery to $4 a keg for nails. An independent pipemaker has adopted quotations similar to those put out a week ago by the Wheeling Steel & Iron Co. and La Belle Iron Works.

An order for 40 miles of 12-inch gas line pipe, involving 3500 tons, has been placed.

Prevailing wage rates for bar iron mills working under an agreement with the Amalgamated association will be continued in the year beginning July 1, according to reports from Atlantic City.

Merger is Completed

A merger of the Ohio Steel Foundry Co., Lima, O., and the Blackwood Steel Foundry Co., Springfield, O., has been completed. The capital of the Ohio company has been increased from $800,000 to $1,000,000, while that of the Blackwood company has been decreased from $450,000 to $2000. No change in policy or manufacturing conditions are contemplated.

Sell Equipment and Defer Chattanooga Works

The bloomingmill, electric equipment and structural steel which were intended for the new plant at Chattanooga under construction by the Chattanooga Steel Co., have been sold to the Allegheny Steel Co., Pittsburgh. It is claimed by C. E. James and associates, who have been promoting the project, that the plan to build a steel works at Chattanooga has not been abandoned, though deferred. Inability to adjust the matter of power requirements with local companies is given as the cause for the cessation of the work and the sale of the equipment.

Fine Showing

Made by Mills in Shipments to Navy Department

Washington, June 27. (By wire.)—A report received by the bureau of construction and repair of the navy department states that shipments of steel for government uses from the Pittsburgh district during May amounted to 69,112,141 pounds, or slightly less than 35,000 net tons. Of this the Carnegie Steel Co. shipped 63,522,930 pounds, or about 32,000 net tons, and other companies 5,589,211 pounds, or about 2790 net tons. This is more than the six months record of such shipments under normal conditions.

Rear Admiral Taylor, chief of the bureau, says it indicates that steel manufacturers are living up to their agreement to meet the navy's requirements and are concentrating on government all shipments of nature such that the government is involved.

The Non-Ferrous Metals

Copper **Lead** **Spelter** **Tin**

New York, June 26.—The uncertainty as to what arrangements the government will make with regard to its munition requirements of various metals has been relieved only in the case of lead in the past week. The government accepted the offer of producers on the lead committee to supply 8000 tons for use until Aug. 1 at 8c a pound. All producers are being asked to participate in this sale. Open market prices at the time the arrangements were announced ranged from 11.50c to 12c, later easing off slightly to about 11.50c, owing to the release of supplies by some large producers who had been out of the market. Current lead quotations are about as follows; Prompt, June and July, 11.50c to 11.75c; August and September, 11.37½c to 11.50c.

But the uncertainty with regard to other metals continues to exert a halting tendency on the market. Consumers of copper still are moving slowly and closing for comparatively small lots. Prices have eased off somewhat the past week, electrolytic now being quoted as follows: Spot, 32.50c; July, 31.75c to 32c; August, 31.25c to 31.50c; September, 30.25c to 30.50c; fourth quarter, 29c to 29.50c, all on the basis of cash, New York. Casting copper has sold at 30.25c for spot carloads the past week. Prompt prime lake continues nominally 31.50c to 32c.

Negotiations are under way by which the government will obtain its next spelter allotment. It is believed that the zinc committee is fixing higher prices this time than on the previous tonnage, but no announcement has yet been made. In the meantime supplies are accumulating and in the absence of active demand prices have eased off the past seven days, prime western now being quoted as follows: Prompt and July, St. Louis, 9.12½c to 9.25c; August, 9.25c; September, 9.37½c.

Inquiry from tin consumers has been inactive. Further trouble has been experienced in the matter of London cables to the New York metal exchange. The tin committee, appointed by the American Iron and Steel institute and accepted by the bureau of foreign and domestic commerce, is as follows: John Hughes, chairman, assistant to the president of the Steel Corporation; E. R. Crawford, president of the McKeesport Tin Plate Co.; A B. Hall, manager of the metal department of the National Lead Co.; Theodore Pratt, of the Standard Oil Co.; John A. Fry, American Can Co. This committee will have charge of the distribution of tin arriving in this country. Spot Straits now is quoted about 62.75c to 63c, New York; Banca, 60c; Chinese No. 1, 54.75c.

Aluminum sellers report some demand from aeroplane builders, but in general the market is quiet and virgin metal has declined slightly. Quotations follow: No. 1 virgin, 59c to 61c; No. 1 remelted, 57c to 59c; No. 12 alloy, 42c to 44c.

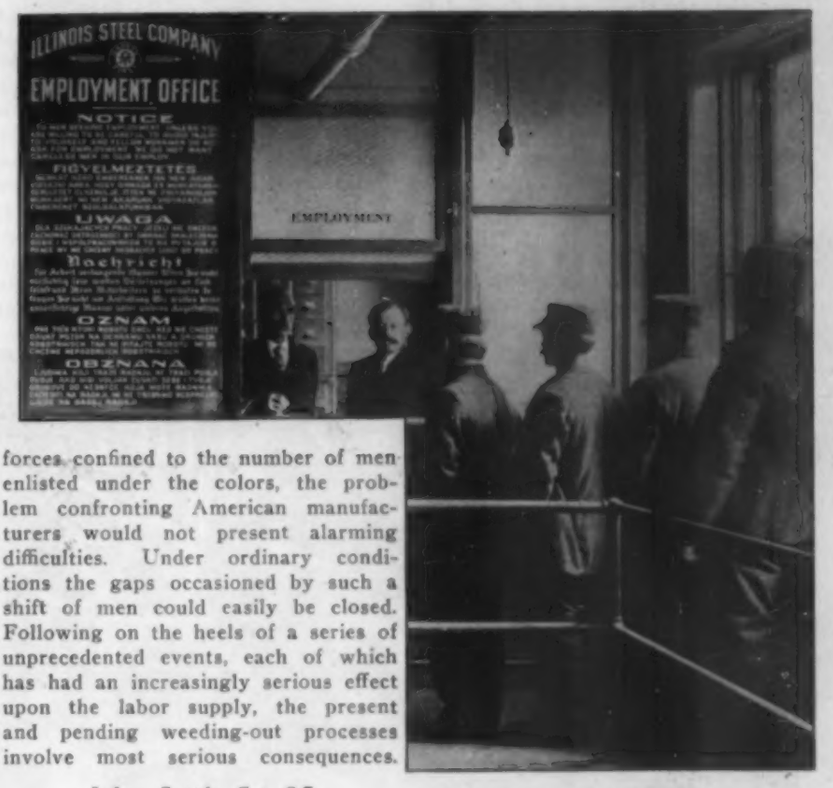
Antimony has been duller this week than at any time for a year, owing to uncertainty as to what the government will do. Spot is obtainable at 19c, duty paid. Futures are quoted as follows: June shipment from the orient, 15.75c; July, 15.37½c; August, 15.12½c.

Demand for old metals is even duller now than in previous weeks. Inquiry for copper and zinc scrap has been consistently light for a month or more and the same condition now applies to lead and aluminum scrap, babbitt, etc. This is due partly to uncertainty in the new metals and partly to the fact that many companies are preparing for their mid-year inventories. Block tin is slightly higher at 52c to 54c. Heavy lead is quoted 10.25c to 10.50c; heavy copper crucibled is steady at 28c to 28.25c.

Filling the Thinning Ranks of Labor

Manufacturers Must Conserve Man-Power by Economizing in Labor and by Replacing Men of Military Age by Older or Younger Men or Women—How Economies Can Be Effected

BY E. L. SHANER



JUNE 5, 1917, will go down in history as the day of typical American achievement. On that memorial Tuesday the youth of the world's greatest democracy demonstrated to the satisfaction of its warring allies and to the discomfort of its stubborn enemies that selective service—or conscription if the uglier term be insisted upon—is no bugbear to a peace-loving people in time of peril. Coincident with this stirring evidence of national unity is the stern realization of the fact that the draft which will follow the registration of the country's young men means the transfer of half a million from the ranks of labor to those of the army and navy.

Were the depletion of the industrial forces confined to the number of men enlisted under the colors, the problem confronting American manufacturers would not present alarming difficulties. Under ordinary conditions the gaps occasioned by such a shift of men could easily be closed. Following on the heels of a series of unprecedented events, each of which has had an increasingly serious effect upon the labor supply, the present and pending weeding-out processes involve most serious consequences.

Labor Supply Cut Off

The first factor to induce the existing labor situation was the cessation of immigration to the United States from European states in 1914 and 1915. As pointed out by H. Cole Estep in "Knocking Out a Billion Dollar Loss" in the Jan. 4 issue of THE IRON TRADE REVIEW, the flow of laborers and tradesmen from Europe dwindled from 1,218,480 in 1914 to 326,700 in 1915 and 298,226 in 1916.

THE SUPPLY OF LABOR IS CUT OFF

The lines of men at the employment windows have dwindled to almost nothing and the young men who in normal times would enter the ranks of industry after grade and high school are now joining the army and navy

In the face of this cutting off of the country's principal supply of workmen, industrial activity, stimulated by tremendous business created by the war, imposed the greatest demand for labor the nation has ever witnessed. Resultant increases in wages for men employed in munitions and manufacturing plants attracted men from the farms, offices, railroads and public utility service. This movement immediately affected the organization of practically every branch of business. The railroads lost many of their trainmen, shopmen, clerks and telegraphers; telegraph companies found it impossible to obtain a sufficient number of messengers; the post offices of the nation soon became undermanned; farmers suffered from lack of help; clerks in retail and wholesale merchandising establishments rushed to lathes and automatics in munitions plants; building contractors found it almost impossible to find common laborers; and even office boys were not to be had in sufficient numbers.

Trailing High Wages

Yet in spite of this drift of men to the manufacturing industries, the mills and factories were short-handed. The high wages offered as an inducement to employes only served to redistribute the available workmen, most of them following the lure of the highest pay check. A notable example of this was the wholesale migration of negroes from the fields of the south to the shops of the north.

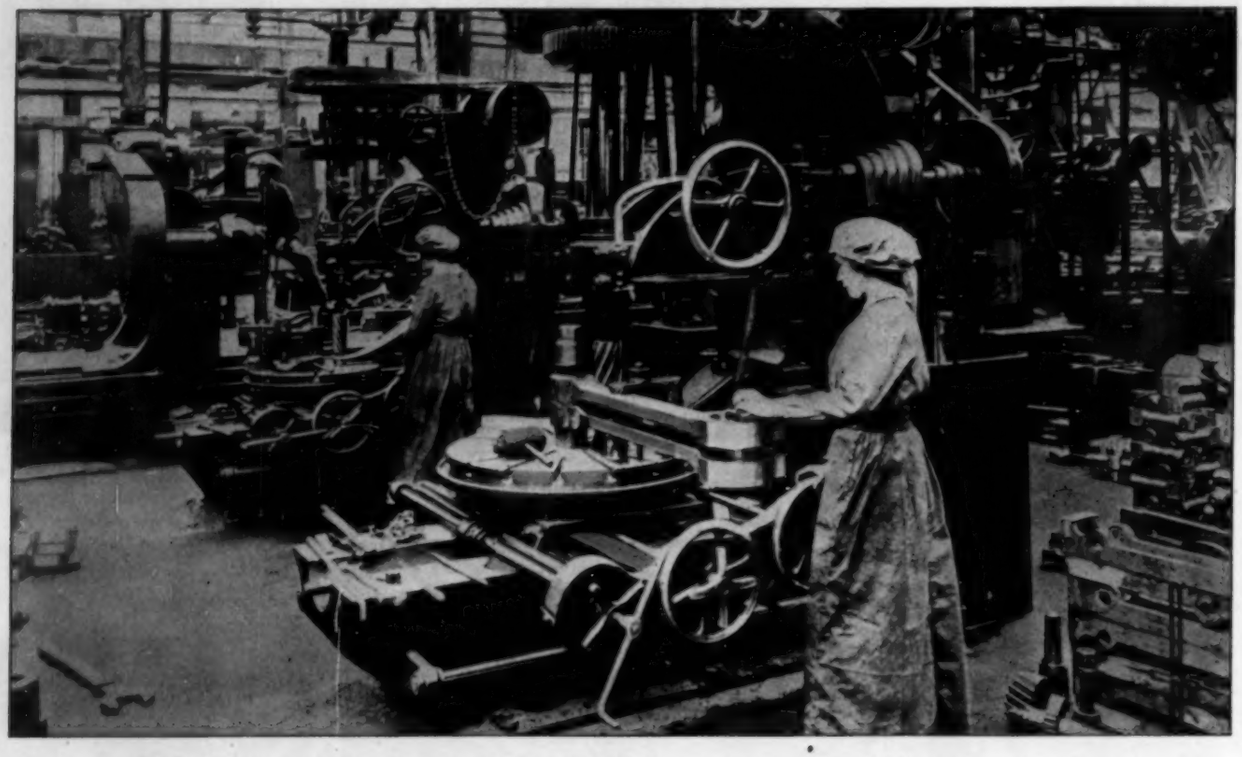
Thus when the President and congress announced that a state of war existed between the United States and Germany, the nation was confronted with a serious labor shortage with no relief in sight. With the first effective efforts toward preparation for actual war, the shortage was accentuated. The best executives of the most important business interests dropped their work to help the government. Their usual tasks had to be distributed to their subordinates down the line. Engineers in ordnance, manufacturing, railroading, construction, metallurgy and other branches left their civilian roles to assist the nation. The financiers responded to the call. This general exodus added further complications to the already complex situation. Moreover the men in the shops, foremen, machinists, molders, machine operators, etc., began to enlist. The huge preparedness program created the need for thousands of shipbuilders, mechanics, etc.

In addition to the jolts given the industrial machine by the developments are the disturbing elements introduced by the excitement provoked by the program of preparedness now being executed so vigorously. Employers cannot rely upon their present forces of labor because they cannot judge the status of the supply from day to day. Enlistments remove their men on a few days', and in some cases on a few hours' notice. It is almost impossible to predict with any degree of accuracy the effect of the draft which is scheduled for the near future.

How Economize in Man-Power?

Manufacturers are therefore compelled to arrive at the following conclusion, which to those who have given the problem close attention, seems to offer the only solution. The maintenance of a smooth running industrial organization depends upon the development of greater economy in labor and the augmenting of the present force of labor. These problems can best be solved by the intensive application of American ingenuity and efficiency and by the adoption of practices which have proved valuable to manufacturers in France and England and to firms in America which have already undertaken the gigantic task.

As for greater economy in the work of men and women in industrial pursuits, it must be admitted that there is an opportunity for vast improvement. Early in the war, a noted Englishman who is well informed on conditions in England and America, compared the spirit of labor in the two countries in the terse sentence "In England, the workman tries to give as much for his day's



WOMEN IN BRITISH MACHINE SHOPS—ILLUSTRATION REPRODUCED FROM *ENGINEERING*, LONDON

wage as possible; in America, the tendency is to give as little as possible". Considered in the light of certain events in American labor circles at the time the statement was made, the contrast was undoubtedly merited. Judged by the situation now prevailing, the inference that the great forces of labor in the United States are deliberately shirking seems ridiculous. Although the relations between employer and employe are far from ideal, the attitude of organized workingmen in the present crisis is tending in the right direction. Under the leadership of Mr. Gompers, the trade unions are displaying a fine spirit of co-operation. As long as this condition prevails, the burden of developing greater economy will rest equally upon employer and employe.

HUNDREDS OF THOUSANDS OF WOMEN ARE ENGAGED IN AEROPLANE MANUFACTURING IN ENGLAND

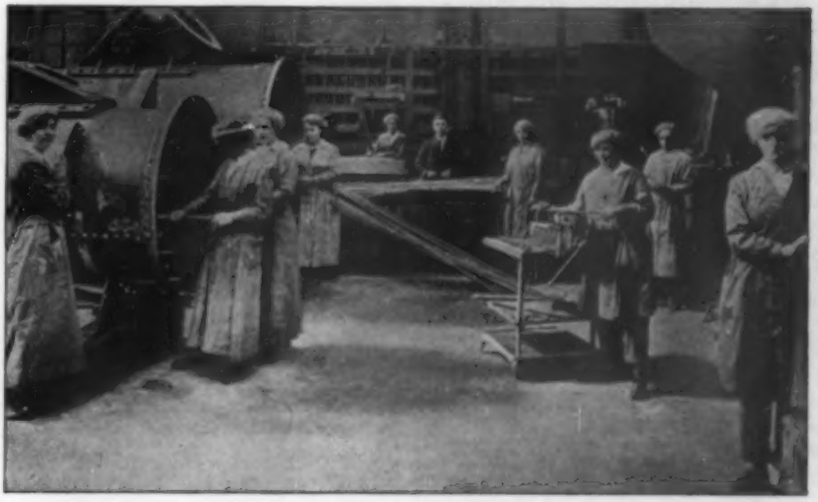
Eliminate Duplicated Effort

Assuming then that the men in the ranks reciprocate in the effort toward greater efficiency, what can manufacturers do to increase the productive capacity of the present force of labor? This question was partially answered at the recent meeting of the American Society of Mechanical Engineers and National Association of Machine Tool Builders at Cincinnati. It was clearly shown that material savings in time and effort could be effected by eliminating unnecessary duplication of experimental work in the manufacture of munitions, machine tools, and other primary and secondary articles of war. It developed that many firms engaged in munitions contracts employ a part of their forces in developing methods of doing certain kinds of work which could be entirely avoided if these firms were afforded the opportunity of profiting by the experience of others who had previously been obliged to go through the same performance. If a number of experts from one plant could visit another shop, and there study the methods employed, they could install this proved and tried practice in their own plant without tieing up a score or more of employes in experimental work in solving a problem that had already been solved elsewhere. This sort of co-operation between manufacturers would go a long way toward conserving the effort of labor.

It is almost unnecessary at this time to mention the urgent need of practicing approved methods of shop management. Industrial engineers have been actively engaged during the past decade in pointing out the losses resulting from slip-shod methods, and although a number of engineers advocate extreme measures designed to increase the efficiency of machines and labor, the employment of a sensible plan of scientific management is so obviously a step in the right direction that manufacturers should not hesitate for a moment in inaugurating the systems best adapted to their needs.

The problem of economy of labor involves a study of the effect of long hours on the productive work done by employes. In a bulletin published by the United States bureau of labor statistics, it is shown that tests made in the munitions plants of England have proved conclusively that in many cases the production has been increased by shortening the working periods. In one case, a gang of 22 men employed in finishing, turning and forming 3-inch shells averaged 100 shells per hour when working 60.3 hours per week, and when the hours per week were reduced to 51.8, the output increased to 114 shells per hour. Similar records are reported by the British health of munitions workers' committee. The conclusions drawn by the committee are that the maximum hours vary for different kinds of work. Whereas 50 to 56 hours per week have proved most satisfactory for men engaged in heavy munitions work, young men on medium weight work perform their duties best when working from 60 to 70 hours per week. The subject of hours of labor is one that every employer should work out for himself. The timing of night and day shifts, length of lunch and rest periods, and schedule of alternating employes between night and day shifts are problems involved in the question of greater economy.

In view of the present demand for labor, it is surprising that no one has instituted a campaign against the holiday evil. During the easy-going times of the last decade, the American public has gradually increased the number of national, state and religious



WOMEN ARE HERE SHOWN RETUBING MARINE BOILERS IN A LARGE ENGLISH PLANT

holidays. In normal times the effect of these frequent festive occasions has not been especially noticeable. Now, however, these wasted days are proving a menace to the industrial machine.

The Holiday Evil

A good example of the accumulative effect of too many holidays is provided by the custom of the coal miners. According to *The Coal Trade Bulletin*, the men in the mines "regularly celebrate all of the state and national holidays, and Pennsylvania has a few in addition to those designated by the federal government. In addition, there are days sacred to the United Mine Workers of America—anniversaries of strikes and days set apart for honoring the union leaders. For example, 'John Mitchell Day' is a big occasion for the miners. As there are between 45 and 50 holidays—national, state, religious and union—which the miners celebrate, allowing for day-after idleness, the operators estimate that about two months of time is lost each year." The holiday evil also seriously affects the steel industry through curtailment of the coke production. Every celebration means the loss of at least two days, as the men at the ovens seldom confine festivities to a single day.

If the holidays can be reduced to half the number, the country will gain the benefit of one man's labor for 5,190,000 days, or the work of 173,000 miners for 30 days. Fortunately the men in the steel mills, munitions plants, and general manufacturing establishments do not observe the excessive number of holidays celebrated by the miners. However, the elimination of even one holiday is of sufficient benefit to the nation in war times that manufacturers should co-operate with employes in reducing the number of wasted days to the minimum. Under the pressure of war, the miner's holidays in England have been reduced 50 per cent.

Every Man in His Place

It is not economical to employ a man of extraordinary strength on a job in which strength is not required; nor is it economical to ask a person of more than average intelligence to perform a task where brute strength is the principal requisite. Considered in this light, there are thousands of plants in the United States where economy is not practiced. Every person who has visited as few as two or three foundries has witnessed strong men working in core rooms where persons with nimble fingers and less strength are better suited to the work.

This brings us to the subject of employment of women in industry. The movement started in Europe soon after the outbreak of the war to enlist women in the factories to perform the work formerly done by men has passed the experimental stage. Women have given a most creditable account of themselves in France, England and Canada, and already the employers of the United States have opened their shops to women workers. In England and France women are engaged in practically all except the very heaviest operations in munitions work, in light machine molding, and in the core room, in machine shops, assembling work, locomotive repair shops, and in machine tool manufacture. In the United States the entrance of women into the shops and factories is just beginning. The railroads were almost the first to utilize women in place of men, and now women are to be found in many of the round houses and inspection points in the country. The employment of feminine workers in core rooms of foundries and in light work in machine shops and manufacturing plants where electrical equipment is made is not new, although at present the number of women thus employed is increasing rapidly.

How Women Can Help

Inasmuch as the experience of the European countries and Canada has indicated that the employment of women offers a satisfactory means of counteracting the shortage of labor, manufacturers on this side of the Atlantic should consider the possibility of introducing this system into their plants. Aside from the necessity of such action, there is the argument that in certain kinds of work, women are more efficient than men. The British committee, already quoted in this article, makes the following statement in one of its reports on munitions workers:

"Heavy munitions work, such as sizing fuse bodies, boring the powder chamber, etc., is not suited to women. On the other hand, light work such as boring top caps and rough-turning 3-inch shells, had better be confined to women, as it is a waste of muscle to appropriate these tasks to men, or even to youths. Very light types of labor such as sedentary gaging operations should evidently be confined to women and girls."

In an interview with Will I. Ohmer, president, the Recording & Computing Machines Co., states in a recent issue of *Factory* that with their deft fingers and willing minds, women workers are taking positions formerly held by men in practically all parts of his plant. He claims that the women are especially effective on the lighter machines and on assembly work, where dexterity rather than strength is the necessary qualification. In another instance, a manufacturer of small milling cutters, tools and heat treated parts, employed women in the tool room when the regular male workers went out on strike. To his astonishment, the employer found that the women turned out better work, and more of it, than the men.

The Trend of Industry

Commenting on the employment of women, a bulletin of the National City bank, New York, states: "It is generally accepted in all advanced countries that with the progress of society, women will be relieved of hard physical labor, and that save for a few years before marriage, and in the exceptional cases, they will not be a factor in the competitive labor market, but the war will seriously increase the number of women who must find their own livelihood, and it is evident that any considerable increase in cost of living will bring large numbers of women into industry."

It is to be hoped that conditions in the United States will not reach the point where it is necessary to enlist women and others in industries to which they are not better adapted than men. However, regardless of what the future may bring forth, the opportunity is now in the hands of every manufacturer to utilize this kind of labor in meeting the shortage which is becoming more and more acute.

Europe Imports Chinamen

A number of the European countries now at war are experimenting with other means of filling the thinning ranks of labor. For instance, the *Boston Transcript* reports that 60,000 Chinese laborers are passing through Canada and Maine on the way to England and France to be employed there. The *Philadelphia Public Ledger* makes the even more definite statement that no less than 100,000 Chinamen are now working in fields and factories in France, and that England and Russia expect to use Chinese workers extensively in both industrial and agricultural development. Moreover, it has been reported that 20,000 other Chinamen have been transported to Great Britain and France under contract to work on docks and highways.

That the United States has also contemplated the use of oriental laborers in filling the gaps of labor

in agriculture and manufacturing is indicated by the occasional attempts made to eliminate the literacy tests for immigrants because of labor scarcity and the war emergency. A number of eastern newspapers have reported that many Spaniards have been employed in Pennsylvania mines, replacing the Slavs who overran the region 25 years ago. The Slavs have migrated to the manufacturing centers where the lure of higher wages has attracted them.

Let Down Bars to Orient?

The immigration problem is one that should be dealt with carefully. There is great danger in letting down the bars to undesirable orientals unless the need of such action is decidedly imperative. In considering any move which would tend to flood the country with these workmen, the situation that would ensue at the close of the war should be considered. Notwithstanding these unpleasant features, Brazil is contracting for a large number of laborers from Japan and China for employment in and colonization of coffee-growing regions. It is obvious that these workmen from the east would be most acceptable in agricultural pursuits and if satisfactory arrangements could be made for their temporary employment in the fields of the United States, they would go a long way in releasing Americans for service in munitions plants and at the front. That more men for operating farms are urgently needed is shown by the reports from various regions indicating a great shortage of farm help. A census recently made in New York state shows that many men have left farms since the war began and that there are now only 84 per cent as many hired men as there were last year.

Other Solutions to the Problem

The action of a number of large corporations shows that there are still other means of increasing the number of employes. The Pennsylvania railroad has found that many of its former employes who are now on pension are willing to return to work in duties which they can perform. It is possible that this method can be adopted by many firms in replacing men of military age. A recent issue of *The Industrial News Survey* reports that several Worcester, Mass., plants are training men of advanced age to perform certain operations in anticipation of shortage of male labor. In Pennsylvania, in view of a labor shortage of 328,000, on farms of the state, the public safety committee has asked all county superintendents of public instruction to release schoolboys of 16 years and over to aid farmers.

At the close of the current school year, the number of students in universities and colleges who had left their respective institutions to engage in military or civilian duties on account of the war was about 50 per cent. Of the 50 per cent remaining a large proportion are qualified to take up various forms of useful work during the summer months. If these young men are enlisted in work to which they are best fitted, the effect on the labor situation should be noticeable. A number of states are taking steps to enroll prison labor in pursuits which will help the production of war materials. The United States department of labor has arranged to place interned enemy aliens in detention camps and employ them at fair wages.

Teamwork is Solution

In spite of all these plans to refill the ranks of labor depleted by enlistment, it is probable that the supply of workmen will be found insufficient. Industrial organizations must be kept intact if the flow of munitions and other war materials to the fighting forces in France and Belgium is to be maintained. After each manufacturer has made every effort to reduce to the minimum the waste of effort of labor in his plant, his next duty is to enter into a fine spirit of co-operation with his fellow employers. As in every achievement, teamwork will play an important part in winning the present war. Teamwork to be effective in the present crisis, must be universally practiced by government manufacturers, labor and public alike. Perhaps the effect of perfect teamwork can be no better illustrated than by the following words of W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., London, speaking at the National Economy exhibition, Sheffield, Eng., May 15:

"If labor and capital could compose their differences and really pull together, the results that might be achieved are staggering. Imagine a foot-ball team in which every member played as slackly as he dared; in which the forwards were jealous of the half-backs, and the halves of the quarters; where no one trusted the captain, and where any section of the team was ready to stop at any moment during the progress of the game while the enemy scored goal after goal, in order to emphasize a real or imaginary grievance. Such a team would be hooted out of existence. * * * We can organize for games and practice all the principles that make for organized efficiency; it is impossible for us to apply those principles to the serious pursuits.

"It is probably no exaggeration to say that if capital and labor work together as loyally as the members of a foot-ball team, our (English) national income could be doubled in a few years. * * * It is surely far more sensible to combine in the creation of new wealth than to dissipate what already exists by quarreling over its possession."

The War in the Air

G. Douglas Wardrop, editor, *The Aerial Age*, recently outlined a tremendous program of aerial warfare now being planned by the United States government. In an illustrated lecture delivered before the members of the Cleveland Engineering society June 12, Mr. Wardrop stated that the war department is planning to put 100,000 aeroplanes in France as soon as possible. He showed that whereas at the beginning of the war there were less than 1000 planes engaged in fighting in Europe, there are now more than 200,000 in such use. He made the interesting statement that the machines of each unit of 15 make a total of from 130 to 140 flights over the enemy's lines each day and that each man drops from 50 to 75 bombs per day. He also illustrated and described the arrangement of automatic guns on some of the larger aeroplanes. He stated that the firing of the guns is synchronized with the movement of the propellers and that the firing is automatic. The guns are mounted on the extreme front of the machine where the operator has an unobstructed view. Mr. Wardrop claimed that if the Germans can be blinded by wiping out their aerial forces, their large guns will become ineffective.

The remarkable growth of the aeroplane industry in England is shown by comparative figures showing the number of firms engaged in making air machines. Whereas before the war there were only 37 companies engaged in this industry in England, there are now 963 partially devoting their time, and 360 exclusively making aeroplanes. In London and its suburbs there are 500,000 women making wings, frames and other parts of aeroplanes.

Mr. Wardrop expressed the opinion that the impetus given the aeroplane by the war will result in the general use of airmachines for pleasure and business. He claims that already plans for aerial mail service in Canada and Africa have been perfected. He predicted that in the near future it will be possible to fly from London to New York and other points around the world on a regular schedule.

Influence of Vanadium on Steels

Experiments With Vanadium Since Its Discovery in 1896 Show That It Has a Great Influence on Physical Properties of Steel—Vanadium Steel is Particularly Suitable for Heat Treatment

BY G. L. NORRIS

THE first metallurgical application of vanadium appears to have been in 1896, when it was used in making several heats of steel at Firminy, France. The results of this test showed a remarkable superiority of the vanadium steel in physical properties. Under the same heat treatment, the vanadium steel showed an increase of 44.8 per cent in elastic limit and 31.5 per cent in tensile strength, with slightly lower percentage of elongation but greater reduction of area.

These tests developed considerable interest in the metallurgical possibilities of vanadium, and the manufacture of ferrovanadium was actively undertaken, notably by The New Vanadium Alloys Co., Ltd., of London, from the vanadium-lead ores of Santa Marta, Spain. It was at the instance of this company that Professor Arnold of Sheffield undertook, in 1899, investigations of the effect of vanadium on steel. These investigations demonstrated conclusively that the presence of a few tenths of a per cent of vanadium gave a remarkable increase in elastic limit and tensile strength without seriously impairing the ductility, or presenting any difficulty in the hot or cold working. Professor Arnold at the time gave it as his opinion that vanadium was undoubtedly the element, which, together with carbon, acts with the greatest intensity in the way of improving alloys of iron; that is to say, in very small percentages.

The following discussion will be confined almost entirely to the consideration of pearlitic-vanadium-ternary steel, or simple carbon-vanadium steel, and will not more than briefly touch on the quaternary-vanadium steels. First, however, the writer wishes to touch briefly upon a still somewhat prevalent popular idea that vanadium is a powerful scavenger, and that the beneficial effects of its use in steel are principally due to its removal of minute, residual amounts of oxygen and nitrogen from the steel. It has even been advanced by some individuals that when all the vanadium

Role of Alloying Elements in Steel

One of the most interesting subjects discussed at the twentieth annual meeting of the American Society for Testing Materials was that of the role of the several elements in the alloy steel. The following papers were presented:

THE ROLE OF VANADIUM,
G. L. Norris, Engineer of Tests, American Vanadium Co., Pittsburgh.

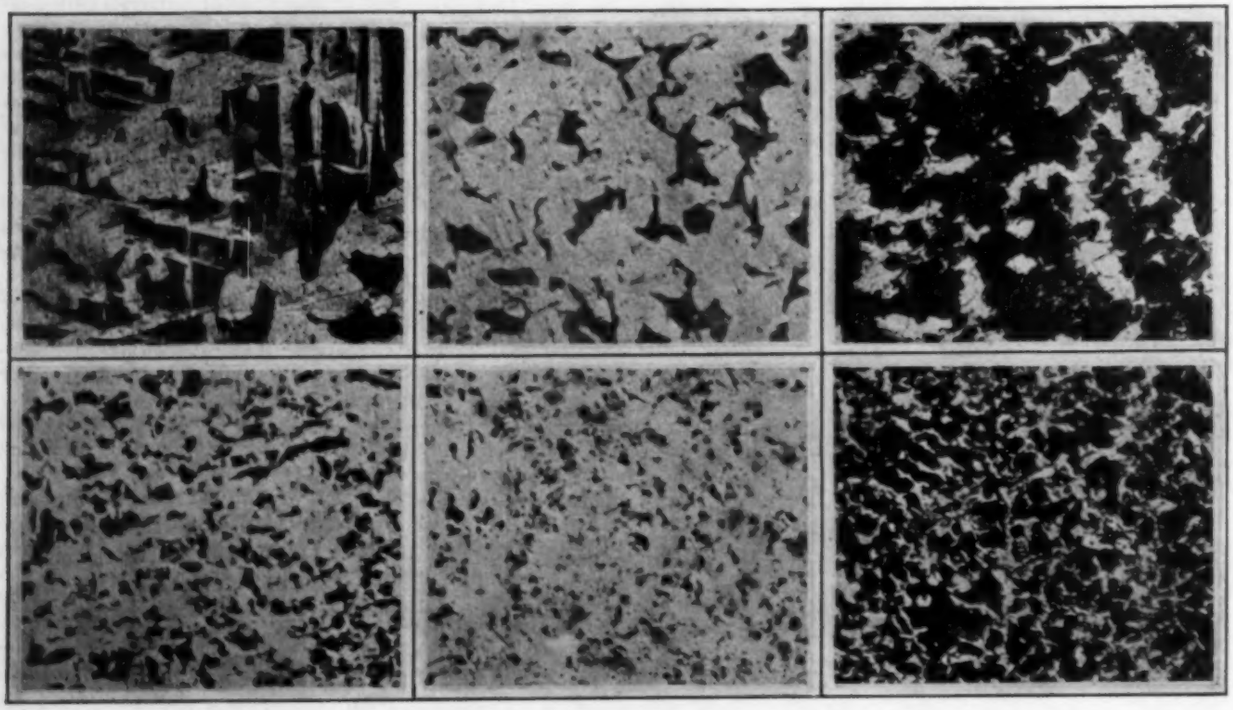
THE ROLE OF CHROME-VANADIUM,
F. J. Griffiths, Vice President, Central Steel Co., Massillon, O.

THE ROLE OF MANGANESE,
Henry M. Howe, Professor of Metallurgy, Columbia University.

THE ROLE OF SILICON,
W. E. Ruder.

THE ROLE OF NICKEL,
R. R. Abbott, Metallurgical Engineer, Peerless Motor Car Co., Cleveland.

Abstracts of these papers are presented under different titles on this and the following pages.



PHOTOMICROGRAPHS SHOWING INFLUENCE OF VANADIUM ON SIMPLE CARBON STEEL

Fig. 1—As Cast

Fig. 2—Annealed 860 Degrees Cent.

Carbon	0.27 per cent
Manganese	0.54 per cent
Silicon	0.29 per cent

Fig. 3—As Cast

Fig. 4—Annealed 860 Degrees Cent.

Carbon	0.28 per cent
Manganese	0.58 per cent
Silicon	0.26 per cent
Vanadium	0.16 per cent

Fig. 5—Annealed at 800 Degrees Cent.

Carbon	0.43 per cent
Manganese	1.30 per cent

Fig. 6—Annealed at 800 Degrees Cent.

Carbon	0.47 per cent
Manganese	0.90 per cent
Vanadium	0.15 per cent

added has been completely used up in scavenging, and none remains in the steel, all the improvement or beneficial effects possible have been accomplished; despite the fact that there is an increase in the mechanical properties of the steel with increasing amounts of vanadium present, and that vanadium has equally as great beneficial effects in steels made under reducing conditions such as crucible and electric furnace steels, as in the case of steels made under oxidizing conditions like open-hearth and bessemer steels. While it is true that vanadium oxidizes readily and will combine with nitrogen, its value as a scavenger is negligible, as there are much cheaper metals that are more effective.

The remarkable effects of vanadium on steel are due entirely to its presence in the steel as an alloying element, and its influence on the other constituents with which it is in combination. When added to steel it is found in both the main constituents, ferrite and pearlite, but principally in the latter. Only a few hundredths of 1 per cent of the vanadium combines with the ferrite. This minute amount, however, appears to increase the strength, toughness, hardness and resistance to abrasion of the ferrite. Nearly all the vanadium, however, is found in the pearlite, in chemical combination with the cementite, as a compound carbide of vanadium and iron in the case of tenary steel, and as more complex carbides in the case of quarternary steels.

Vanadium in Cementite

Vanadium replaces the iron in the cementite or the carbide by increasing amounts until finally when the percentage of vanadium is about 5 per cent all the iron has been replaced by the vanadium. The vanadium-containing cementite is not as mobile as ordinary cementite and consequently does not segregate into as large masses, but occurs in relatively minute particles and, therefore, is more uniformly distributed. It does not, consequently, readily occur as lamellar or thin plates in the pearlite, but in a granular or sorbitic condition. This strong tendency of vanadium to form sorbitic and even troostitic pearlite, is doubtless one of the reasons for the mechanical superiority of steels containing vanadium, not only statically but dynamically.

Vanadium carbide is not as readily soluble on heating as iron carbide, and consequently vanadium steel requires a higher temperature to dissolve the cementite and put the steel in the austenitic condition for quenching.

The presence of vanadium does not raise the *Ac*1 and *Ar*1 points more than about 10 degrees Cent.., and repeated heatings do not seem to lower the *Ar*1 point. The *Ac*2-3 and *Ar*2-3 points are raised somewhat more and continue to rise with increase in percentage of vanadium. The effect of vanadium on the physical or mechanical properties of steel increases with the percentage of vanadium until about 1 per cent is present, after which there is a decrease, even in the case of quenched steels, and with 3 per cent or more of vanadium the steel is actually softened on quenching until unusually high temperatures are reached, say about 1300 to 1400 degrees Cent.

Vanadium-steel hardenite has a greater thermal stability, or power to withstand elevated temperatures without softening or breaking down or separation of cementite. This property is responsible for the great improvement in high-speed steels, through the addition of vanadium to stand up longer under the high temperatures developed at the point of the tool in taking heavy cuts at high speed. Percentages of vanadium as high as 3.50 have been successfully used in high-speed steel, and 1.50 to 2.50 per cent are not uncommon, although only a few years ago the percentage ranged from 0.30 to 0.75, and it was thought that the addition of over 1 per cent gave very little additional advantage. The improvement in high-speed steel through the use of vanadium has borne an almost direct relation to the percentage of vanadium present, and is considered to be from 60 to 100 per cent.

In the case of carbon-vanadium tool steel the use of vanadium has proved almost equally beneficial, although at present only about 0.2 per cent of vanadium is used in such steel. It has a wider quenching range—that is, can be heated higher without injury—hardens deeper, retains cutting edge longer, and is very much tougher and stronger. A bar of 1 per cent carbon tool steel containing 0.25 per cent vanadium, quenched and drawn back at 400 degrees Cent., will bend 90 degrees without failure whereas a similar steel without vanadium will bend only about 20 or possibly 30 degrees. Comparative compression tests of such tool steels with like tempering or draw back gave on 1¼-inch cubes, 490,000 pounds for the vanadium steel and 278,000 pounds for the steel without vanadium. For battering tools, such as pneumatic chisels, calking tools, rock drills, etc., vanadium tool steel possesses marked superiority on account of its combination of hardness, strength and toughness.

One of the principal applications of vanadium steel has been for steel castings, particularly for locomotive frames. The composition of the steel is the same as usual for such castings, excepting for 0.15 per cent or more vanadium. The addition of this small amount of vanadium increases the elastic limit of the annealed castings, 25 to 30 per cent without lowering the ductility. The tensile strength is not increased proportionately in the case of thoroughly annealed castings, but is usually 10 to 15 per cent greater. The following averages of tests within the same ranges of composition are typical:

AVERAGE CHEMICAL COMPOSITION

Carbon, per cent	0.25
Manganese, per cent	0.62
Silicon, per cent	0.27
Vanadium, per cent	0.18

PHYSICAL PROPERTIES

	Carbon steel	Vanadium steel
Elastic limit, lb. per sq. in...	36,495	48,210
Tensile str'gth, lb. per sq. in.	73,820	79,930
Elongation in 2 in., per cent.	27.3	26.6
Reduction of area, per cent..	46.0	48.1

For reasons apparent from what has been previously stated, vanadium-steel castings require a somewhat higher annealing temperature than ordinary steel castings. They are also more susceptible to hardening, and therefore should be cooled slowly in the annealing furnace until they have cooled below the *Ar*1 point. The annealing temperature should be about 875 degrees Cent.

Value of Heat Treating

There is a growing tendency to heat treat, quench and temper steel castings for many purposes. Vanadium steel is much more suitable for heat treatment than ordinary steel, as it hardens more on quenching and consequently much higher physical properties can be obtained. Even air cooling from the annealing temperature, followed by an annealing at a low temperature, greatly increases the elastic limit without affecting the ductility. One company by this treatment meets the following minimum physical requirements with vanadium steel of the average chemical composition previously given:

Elastic limit, lb. per sq. in.	65,000
Tensile strength, lb. per sq. in.	80,000
Elongation in 2 in., per cent.	20
Reduction of area, per cent.	40

Tests of quenched and tempered castings of this same composition show as follows, the quenching and draw-back temperatures being the same for both steels:

	Carbon steel	Vanadium steel
Elastic limit, lb. per sq. in...	58,630	72,860
Tensile str'gth, lb. per sq. in.	90,630	95,630
Elongation in 2 in., per cent.	23	26
Reduction of area, per cent..	52	56

For higher carbons, the advantage in favor of vanadium steel is even greater. Water was the quenching medium.

Use for Locomotive Forgings

A large field for annealed or normalized carbon-vanadium steel is its use for locomotive forgings. It is generally conceded that there is need for a steel of greater strength, not only to meet present conditions, but also to permit of reducing sections of reciprocating parts to obtain better counterbalancing. To meet this requirement, the railroads several years ago turned to heat-treated

carbon and heat-treated alloy steels, notably chrome-vanadium. The use of heat-treated locomotive forgings has not proved altogether satisfactory for a number of reasons. One objection to the use of these forgings is the lack of heat-treating equipment in most railroad shops. This operates particularly in repair work where for any reason the forging has to be locally heated to straighten, stretch or shorten, destroying thereby the effect of the original heat treatment and producing inequalities which may result in failure. Probably no other class of forgings is subject to as abusive use as locomotive forgings, and under such conditions ordinary heat-treated forgings have not been found reliable. For these and other reasons annealed forgings are preferred. Consequently, a steel that could give in an annealed condition physical properties equal to or even better than those specified for heat-treated carbon-steel forgings, would prove very desirable. The accompanying photomicrographs illustrate the marked influence of vanadium on this microstructure of simple carbon

Nickel-vanadium steel, while having possibly even higher tensile properties than chrome-vanadium steel, is considerably more expensive and has not been found to meet all conditions as satisfactorily as chrome-vanadium steel. It does not appear to have as high a resistance to shocks and repeated stresses.

The Uses of Chrome-Vanadium Steel

BY F. J. GRIFFITHS

CHROME-VANADIUM steel holds the position virtually at the head of the commercial alloy steels, and owes this prestige to the extremely wide range of physical qualities which are capable of being developed from this metal by proper methods of heat treatment. Like all alloy steels, it is, as its earlier name signifies, a special steel, meaning not only that it is designed for special purposes, but also, that its preparation for the particular work it is called upon to perform must be carried out along certain lines calculated to yield in the final result, those qualities which shall represent 100 per cent efficiency in the final product.

Chrome vanadium combines in such a manner with iron, that the separate constituents of the final alloy produced cannot be distinguished. A homogeneous blending of the allied elements which defies detection is discovered. This phenomenon indicates a quite strong combination between the alloying elements and defines the combination unmistakably.

Chrome-vanadium alloys with iron in all proportions and affects the properties to a marked degree, depending upon the percentage of chrome vanadium present. The qualities which become inherent are influenced also more or less proportionately by the amount of carbon contained. The presence of chrome vanadium in steel intensifies the effect of the carbon in all the best qualities, which it is capable of producing alone. These increases take form not only in physical results, dynamic strength, resistance to wear, increased hardening power, lack of brittleness, etc., but also in purity, soundness and homogeneity of the metal. These are the specific contributions which chrome vanadium brings to iron as compared to the older simple steel. Unfortunately, many of these qualities enumerated have no current and accepted method of measurement, whereby they may be offered on a basis for comparison.

The property of soundness of the casting and ingots, produced by the use of chrome vanadium, induces freedom from occluded gases and greatly increases the desirable physical qualities of the forgings subsequently made from this steel, such as strength, ductility and resilience. These desirable properties are amply proved not only from the results obtained from tests, but also from the more vital trial of actual use.

According to the old view and judging from the results of tests chrome-vanadium steel, as rolled or annealed, may appear to be a worthless product. It may have, as in examples to be given later, a percentage of elongation, reduction of area, elastic limit and ultimate strength corresponding to simple carbon steel.

One of the principal effects produced in steel by the addition of chrome vanadium, is to raise the temperature at which the carbides dissolve in the iron, and the temperature at which they are precipitated out of solution. This elevation of the solution temperature is quite noticeable, the carbon content affecting this temperature but slightly. In connection with the question of the position of the critical ranges of chrome-vanadium steel, Figs. 1, 2, 3 and 4 show both the heating and cooling curves obtained by means of a Leeds & Northrup transformation-point apparatus. The peak of each curve on heating occurs between 770 and 793 degrees Cent. and the greatest extension of the cooling curve is found to branch out at about 695 degrees Cent. These curves, taken with the Leeds & Northrup apparatus mentioned above, indicate the temperature relationship between the sample being tested and a uniformly heating body heated together in the same furnace. In the chart the actual temperatures are plotted as abscissas and the temperature differences as ordinates. The

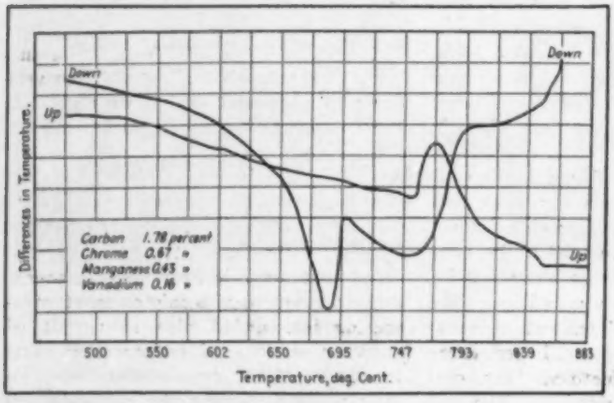


FIG. 1

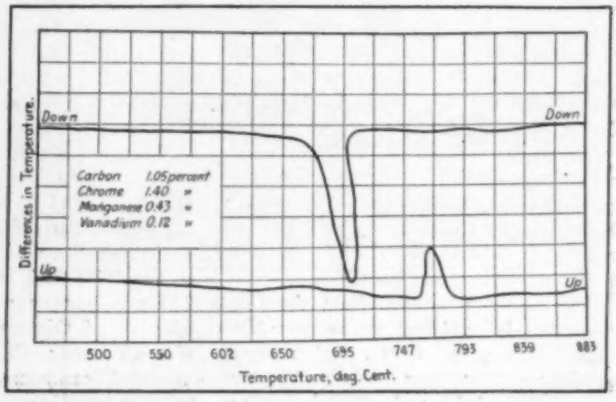


FIG. 2

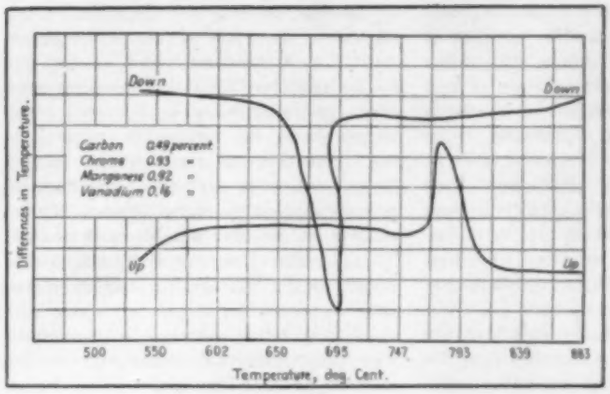


FIG. 3

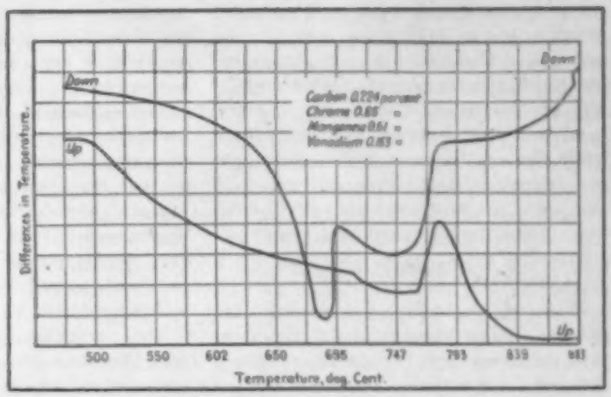


FIG. 4

temperature differences, however, are not given definite values in degrees in these curves inasmuch as this is taken care of by the instrument itself, which is specifically designed to record this difference autographically. These four steels have respective carbon contents of 0.17, 0.22, 0.49 and 1.05 per cent, with varying chromium and vanadium contents. They show the wide transformation ranges at the high temperatures characteristic of this alloy. It will be noted that the range of temperature intervening between the completion of the upper transformation on heating and the completion of the lower transformation on cooling is approximately as follows:

CHROME-VANADIUM STEEL WITH	
0.17 per cent of carbon.....	183° C.
0.22 per cent of carbon.....	170° C.
0.49 per cent of carbon.....	138° C.
1.05 per cent of carbon.....	100° C.

Figs. 1 to 4, inclusive, furnish conclusive evidence that when chrome vanadium is added to steel, it raises the critical points on heating above the corresponding carbon-steel temperatures, but on cooling the critical point is considerably depressed, roughly in proportion to the maximum temperature from which the steel is cooled. The higher the maximum temperature reached the lower the critical range will be on cooling. This fact serves to show the slowness which which the structural changes occur in this alloy and the additional time required for the transformation to be effected completely.

Chrome vanadium seems to attain its greatest combination of desirable qualities at higher treatment temperatures than would be expected from the location of its critical range, due principally to the greater length of time necessary to effect the complete transformation of its constituents into a uniform and homogeneous solid solution. This point is emphasized because certain other commercial alloy steels, although excellent in many respects, have very narrow limits of annealing and hardening temperatures, and therefore require unusual care in their treatment, a slight deviation from the correct temperatures resulting unsatisfactorily.

A single quenching and drawing treatment is sufficient for general purposes to effect complete refinement and hardening of chrome-vanadium steel. This characteristic of simplicity in treatment obviously insures a high-grade product under ordinary commercial conditions, and when compared with the double and triple heat treatments required for the refinement of other alloy steels, the economy presented is obvious. These properties, possessed only by the chrome-vanadium alloy, characterize this steel as a material universally applicable for any commercial requirement. They also simplify the treating instructions necessary to successfully handle alloy steel of this chemical composition. One heat-treating specification is adaptable for any carbon analysis, whether the steel is destined for case-hardening purposes or for oil-treating for gears and cones, etc. It has been found by experience that a temperature of 775 degrees Cent., which is suitable for hardening a case-hardening steel and still retain desirable toughness of the core, can also be employed for hardening oil-treated parts.

We have found then from the foregoing remarks that chrome-vanadium steel can be truly described as a universal steel. With the carbon present in variable amounts, almost any physical property desired can be secured. It is adaptable for case-hardening where the carbon should not exceed 0.20 per cent, that is, for axle shafts, etc., where nominal strength is essential; for oil-treated gears and vanadium springs, where great resilience and resistance to repeated shock is required; for dies, where surface hardness and toughness must both be present; for drills, etc., where wear-resisting qualities and lack of potential brittleness is necessary; for cones and raceways of bearings, which must possess a glass-hard surface, accompanied with proportionate toughness to prevent checking and cracking under the stresses imposed.

The adaptability of chrome-vanadium steel is general, and where strength and hardness and resistance to fatigue properties are the prerequisite, there is a chrome-vanadium steel for the purpose. When the steel is case-hardened, a glass-hard surface and tough fibrous core are easily obtained. These properties are obtained without complex treatment, consisting of simple quenching, with reheating and quenching. For other heat-treated parts, a simple heating, quenching and drawing gives a steel, relatively so tough and strong, that it is unlike any other hardening alloy steel.

The Retarding Action of Manganese

BY HENRY M. HOWE

BEFORE considering the retarding of the transformations by manganese let us refresh our memory as to the three prominent states of steel, between which they play: The common low-temperature alpha or pearlitic state; the high-temperature or non-magnetic austenite state into which the metal passes spontaneously when heated up through the transformation range, say 725 to 900 degrees Cent., *Ac*1-*Ac*3; and the intermediate or martensitic state, in which carbon steel is caught in transit from the austenite to the pearlite state by means of a rapid cooling, as for in-

stance on hardening by quenching small pieces in water. The alpha state is magnetic and relatively soft and ductile, as in annealed carbon steel; the intermediate or martensitic state is magnetic, hard and brittle as in hardened steel; while the non-magnetic high temperature or austenitic state when preserved in the cold, as in manganese steel, combines great ductility with hardness.

Retard Transformation

Most of the alloying elements, and notably carbon, manganese and nickel, retard this transformation greatly. Thus 2 per cent of manganese plus 2 per cent of carbon retard it so that in the water quenching of thin pieces the austenite state is preserved. With 5 to 7 per cent of manganese it is so slow that even in air cooling it goes only as far as the intermediate martensitic state; hence the brittleness of these steels of intermediate manganese content. With say 12 per cent of manganese the transformation is so sluggish that the austenitic state is preserved even through a common slow cooling. The water-quenching of manganese steel in current manufacture is no to prevent the loss of the austenitic state, but to suppress the precipitation of the iron-manganese carbide, cementite, which would occur during the slow cooling.

The industrial value of this manganiferous austenite or manganese steel seems to be due to its combination of great ductility with great effective hardness. I say effective hardness, because initially it is rather soft. The Brinell hardness of an undeformed specimen is only 125, or that of steel of about 0.22 per cent of carbon when annealed, that of ultra low-carbon steel being about 75. But the hardness increases very greatly on the slightest deformation. Even that incidental to the Brinell test increases the observed Brinell hardness to 223 easily, or to that of 0.60 per cent carbon stel when annealed.

Hardening Under Deformation

This hardening under deformation is one of the first things that forces itself on the user of this material. The first strokes of the hack saw cut it rather easily, but the deformation thus set up in the path of the saw quickly causes such hardness as to bring the sawing to an abrupt end, thus giving the absolutely false impression that the material has a soft skin. This hardening causes the apparently contradictory combination of effective hardness with very low proportional limit, even as low as 28,250 pounds per square inch. The proportional limit represents the cohesion of the undeformed material; the effective hardness represents the cohesion as exaggerated by the deformation incidental to service. In the same way the act of tensile rupture may increase the Brinell hardness to 540, or that of about 0.50 per cent carbon steel when hardened.

The surface of the jaw of a manganese-steel rock crusher, deforming under the great pressure, quickly hardens itself, so that the combination of a very hard surface with a ductile back develops spontaneously. As fast as this hard surface wears away it is replaced by a new one made equally hard by the deformation which it at once receives.

The hardening probably represents in part the same cause which leads to the increase of cohesion in general, including the hardness, of all the malleable metals under all forms of deformation, such as wire drawing, and in part the martensitization of the austenite. That is to say, the arrested transformation from austenite through martensite to the alpha state which is due in cooling through the transformation range but is restrained by the retarding action of the manganese, is now stimulated by the deformation sufficiently to cause it to proceed as far as the martensitic state, with consequent hardening and embrittling effect. This martensitization through the stimulation of the arrested transformation by deformation is a common property of austenitic steels which have only a moderate excess of the retarding elements over the quantity needed for causing the retention of the austenitic state. It occurs strikingly in austenitic 20 per cent nickel steel.

The retarding effect of manganese on the structural changes of carbon steel shows itself by leading in general to finer structure, to finer ferrite masses, finer network structure, and finer pearlite, indeed probably often to the replacing of lamellar pearlite with sorbite. This greater fineness leads to better quality in general, and to a higher elastic limit in particular, though of course with a corresponding sacrifice of ductility. The great value of manganese for this purpose has not begun to receive the attention which it deserves. It is probable that a manganese content of say 1.25 per cent, with a correspondingly lessened carbon content, may be used so as to lessen the danger of cracking and the residual stresses when a high elastic limit is sought, because this large manganese content in and by itself raises the elastic limit by giving a fineness of structure which otherwise would be sought by increased violence of cooling or by the use of a lower drawing temperature. In other words, the use of 1.25 per cent of manganese lessens the needed violence of cooling, and permits the use of a higher drawing temperature, in both ways tending to mitigate the residual stresses, and in the former way lessening the chances of cracking.

How Silicon Affects Steel

BY W. E. RUDER

IT IS held by general opinion that the effect of small percentages of silicon, such as are met with in carefully made steel from any process, upon the mechanical properties is negligible. Where it has been found in proportions exceeding 0.1 per cent and poor results obtained, such results are usually traceable to accident or lack of care in manipulation during the process of manufacture.

In most of the investigations the effect of silicon, particularly in amounts less than 1 per cent, have been masked or modified by the presence of varying percentages of manganese and carbon. In a recent paper Yensen has re-examined the series of forgeable silicon' alloys using as a base pure electrolytic iron and giving us a more exact idea of the effect of silicon alone. Although his figures differ in some cases from those found by previous investigators the general trend of his curves is the same.

Silicon increases the tensile strength of pure iron from 38,000 to about 90,000 pounds per square inch at 4 per cent in annealed samples. Beyond this point the value rapidly falls off. The elastic limit is likewise steadily increased up to 4 per cent silicon. The ultimate elongation and reduction of area are practically unaffected until 2.5 per cent of silicon is reached. From this point the drop is rapid.

Whereas Yensen's values for elastic limit and ultimate strength are generally lower than those of previous investigators, his values for reduction of area and ultimate elongation are in general higher, particularly for silicon content below 2.5 per cent. This would indicate that silicon in itself does not cause brittleness when below 2.5 per cent, and that the presence of small percentages of carbon increase the strength at some sacrifice of ductility. The decrease in ductility is about coincident with the beginning of the marked tendency for large grain growth which silicon imparts to mild steel and with the beginning of the precipitation of graphite.

Although the limit of forgeability is given as about 7 per cent of silicon, the practical limit for sheet rolling is something under 5 per cent.

An interesting new development in

the study of iron-silicon alloys is noted in Yensen's work in which he appears to have established a heretofore unnoticed critical point at which there is a sudden drop in all mechanical values at about 2.5 per cent of silicon. The phenomenon was first noticed from the fact that two ingots in this range broke up in forging. A further examination showed that there was a sharp drop in all values at 2.5 per cent and an equally sharp recovery at 2.7 per cent of silicon. The formation of a compound $Fe_{10}Si$ is suggested as an explanation, but seems hardly adequate. However, no satisfactory explanation has yet been arrived at.

Effect of Silicon Upon the Critical Points

Gumlich has shown that the second magnetic transition point is steadily lowered with increased silicon content until it reaches a value of about 660 degrees Cent. for 8.35 per cent silicon, while the first (pearlitic) point steadily rises, the two coinciding at 2.2 per cent silicon, and becomes practically extinct at 2.5 per cent silicon. In an exhaustive study Charpy and Cornu-Thenard later confirmed this observation and definitely connected the disappearance of the *A*1 point with the precipitation of graphite.

Just as tungsten, chromium, nickel and manganese have found their specific uses when alloyed with iron, so also silicon quickly found its place as an alloy for magnetic circuit for alternating fields. Although carbon steels containing from 0.2 to 0.4 per cent of silicon are made for tires and automobile springs, and certain tool and gun steels are reported to have from 0.3 to 0.6 per cent of silicon, the almost exclusive use of silicon alloys is for magnetic circuits. Something over 100,000 tons of silicon alloy sheets were used in this country alone during the past year.

Silicon raises the resistivity of mild steels about 10 microhms per cubic centimeter for each per cent added, so that a silicon steel containing 4.5 per cent of silicon has a resistivity of 59 microhms per cubic centimeter. This has an important effect in reducing the eddy current losses.

Gumlich found that the coercive force was very greatly improved by the addition of 0.06 per cent of silicon in both rods and sheets. This improvement continued in the sheets, reaching its lowest value at 0.4 per cent of silicon and thereafter rising. In rods, however, there is an immediate rise up to 1 per cent of silicon, and then a gradual falling off. Yensen, on the other hand, working with very pure alloys in the shape of rods only, finds two minimum points of equal value, one of 0.15 per cent silicon and one at about 4 per cent. In maximum permeability there is fair agreement as to the shape of the curve, that is, each shows two maximum values at about 0.2 and 3.5 per cent, respectively, although their numerical values differ very greatly. In this case, however, we are comparing Yensen's rods with Gumlich's sheets. From his rods the latter gets widely different and unexplained results.

The explanation of the wide difference which Gumlich finds between sheets and rods and the agreement in the shape of his curves for sheets with those of Yensen's rods probably lies in the fact that the former's sample contained from 0.18 to 0.34 per cent of carbon. This carbon remained in the combined form for the rods under 2 per cent silicon, while in the sheets it precipitated out as graphite, this graphitization being aided in this case by the freer access of oxygen during the annealing and possibly by the fact that it had more severe mechanical working.

Summary of the Various Effects of Silicon in Steel

The effect of silicon, therefore, seems to be, unlike that of the ferromagnetic metal cobalt, an indirect one. Its first effect is to act as a deoxidizer, its presence in small percentages indicating its excess over the amount of removable oxygen originally present, and therefore explaining the first peak in permeability curve and depression in hysteresis value. From this point on to about 2 to 2.5 per cent, the silicon merely acts as a diluent causing a steady drop in saturation value and permeability and an increase in coercive force. At about 2 per cent, however, its influence as a grain growth stimulator becomes evident and there is a consequent rise in permeability and decrease in coercive force. This effect reaches a maximum and from this point onward any added silicon again acts as a mere diluent.

The increased solvent power for gases imparted by the silicon and the decreased solvent power for carbon are also undoubtedly large factors where these are present. In commercial silicon steels these properties are of the utmost importance. Charpy and Cornu-Thenard have shown that a 3.9 per cent silicon steel containing 0.14 per cent of carbon had its carbon completely separated out as graphite after an annealing of three hours at 800 degrees Cent. This graphitization accounts in part for the second maximum point, particularly in alloys containing over 0.1 per cent of carbon.

Effect of Grain Size on Hysteresis

The effect of grain size on the two components of total watt loss, namely, hysteresis and eddy currents, and upon the permeability, is interesting and the reason is not altogether clear. Increased grain size causes a decrease in hysteresis and an increase in permeability at medium and low densities. The eddy current losses increase with the grain size but apparently not in as direct a ratio as the decrease in hysteresis. From recent data, this increased permeability seems to be due to a higher permeability in the direction of crystal orientation and the high eddy loss to a consequent non-uniform permeability in the cross-section tested.

Heretofore it has been considered that the resistivity of the material and the thickness of laminations were the sole factors governing the eddy current losses, but I have found many cases where the eddy current losses have been doubled with increased grain size without change in resistivity or thickness in lamination.

Increased grain size in the direction of rolling also accounts for the increased permeability and decrease in watt loss of silicon steel when tested in sheets cut parallel to the direction of rolling when compared with those cut across.

Role of Nickel in Steel

BY R. R. ABBOT

IN ITS most simple form steel is a more or less rigid mechanical mixture of pearlite and iron, the pearlite itself being a much finer mechanical mixture of cementite, Fe_3C, and iron. In common with such mechanical mixtures the physical properties of this alloy bear some ratio to the percentage of its constituents. For various reasons the ratios of these physical properties are not straight-line functions of the carbon contents. One of these reasons is the fact that, practically, we do not have a perfect mechanical mixture, but the iron always carries some carbide in solution, the amount of which increases with the carbon content of the alloy. Another reason is the changing ratio between the areas of the boundaries between the iron and the cementite, and the amount of these two constituents as the percentage of carbon varies.

Fig. 1 represents the relations existing between the carbon content and the elastic limit, tensile strength, reduction of area and percentage of elongation of pure iron-carbon alloys up to 0.9 per cent of carbon (approximately from 0 to 100 per cent of pearlite). Fig. 1 does not represent ordinary steels, as the influence of nothing but carbon is considered. For the sake of simplicity and because it represents very accurately true conditions, it has been drawn as two lines with the break at 0.45 per cent of carbon. It also represents perfectly annealed alloys. Cementite is extremely hard, strong and brittle; iron is soft and ductile; therefore, we should expect to obtain with any single alloy, physical properties depending upon the percentage composition of the constituents.

In order to make a change in the physical properties of any individual alloy of this series, we could change the nature of the pearlite, change the nature of the iron, or change the nature of both the pearlite and the iron. In practice the physical properties of this simple iron-pearlite alloy is changed by adding various elements to it; changing the relative amount of free iron present; and by a combination of both of these methods.

The effect of alloying nickel with pure iron is to increase the elastic limit, tensile strength, and reduction of area, but to decrease the percentage of elongation. This effect is the same when carbon is present, and it is found that a given amount of nickel produces about the same change in physical properties, irrespective of the percentage of carbon.

The average effect of nickel up to 8 per cent, upon an iron-carbon alloy is as follows: 0.01 per cent of nickel increases the elastic limit 40 pounds per square inch; the tensile strength 42 pounds per square inch; the reduction of area 0.005 per cent; and decreases the elongation 0.010 per cent.

Expressing this for a 3.5 per cent nickel steel, which is the most common commercial alloy, we see that such a nickel steel should have 14,000 pounds per square inch higher elastic limit, 14,700 pounds per square inch higher tensile strength, 1.5 per cent greater reduction of area, 3.5 per cent less percentage of elongation than, a steel of the same analysis, but without the nickel. (By the percentage of reduction of area and elongation is meant the actual number of units of change. For example: A steel with no nickel has a reduction of area of 53 per cent and an elongation of 26 per cent; the same steel with 3.5 per cent nickel would have a reduction of area of 54.5 per cent and an elongation of 22.5 per cent.)

The elastic limit and tensile strength are then increased by nickel due to the increased properties of the solid solution of the nickel in the iron. The reduction is practically altered but little, but the elongation is decreased.

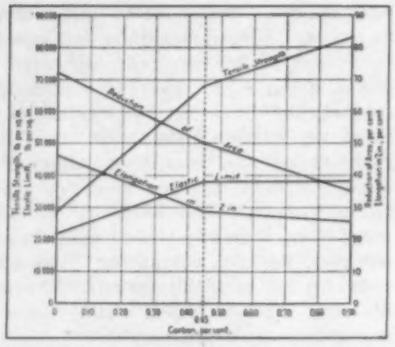


FIG. 1—RELATION BETWEEN CARBON CONTENT AND PROPERTIES

When a plain carbon-iron alloy is heated above the upper critical point, *Ac3*, the cementite is dissolved in the iron of the pearlite at the passage through the lower critical point, *Ac1*, and this solution progressively dissolves the remaining iron during the heating up to the *Ac3* point, at which point it is all dissolved and the solution is homogeneous. Upon cooling, the reverse action takes place, but when nickel is present this separation of the cementite from the iron-nickel solution does not progress as completely nor as easily as from a plain iron solution, and therefore the pearlite areas in a nickel steel are larger and much poorer defined than would be the case in the same steel without nickel. This effect becomes more marked the more rapid the cooling, and since the pearlite areas are much stronger than the iron areas we find that in practice a nickel steel, compared to one without nickel, when air-cooled, will have a higher increase in tensile strength than that given above, a perfectly annealed alloy.

When steel is broken down too rapidly in rolling, it frequently shows a decided segregation of the pearlite areas along lines parallel to the rolling direction. Nickel apparently tends to intensify this effect and occasionally under even normal rolling this condition is encountered in nickel steel.

Fig. 2 represents the critical temperatures for a pure iron-pearlite hypereutectoid alloy upon heating. Line *GOS*

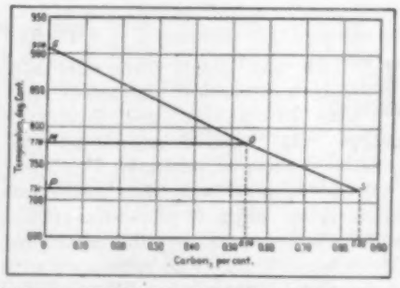


FIG. 2—CRITICAL TEMPERATURE FOR IRON-PEARLITE ALLOY UPON HEATING

represents the upper absorption point, *Ac3*, *MO* the magnetic point, *Ac2*, and *PS* the lower absorption point, *Ac1*.

The lower and upper absorption (critical) points upon heating, as well as the magnetic critical point, are all lowered by the addition of nickel. The amount of the lowering is given approximately by the following:

0.01% of nickel lowers *GO* ..... 0° .235 C.
0.01% of nickel lowers *OS* ..... 0° .180 C.
0.01% of nickel lowers *MO* ..about 0° .087 C.
0.01% of nickel lowers *PS* ..... 0° .103 C.

In working with the *Ac2* point these figures are not based upon as accurate an investigation as for the *Ac1* and *Ac3* points. As the nickel contents are increased and the critical temperature progressively lowered, it is evident that finally the upper absorption point will reach the temperature of the atmosphere (20 degrees Cent.) and we will have an austenitic alloy; the greater the amount of carbon the less nickel it takes to reach this condition. Also as the nickel increases points *O* and *S*, in Fig. 2, move to the left until they finally successively coincide with *G*. As soon as the line *MO* or any point on *OS* are brought below the temperature of the atmosphere, we have a non-magnetic alloy.

A heat-treated nickel steel, while having a lower reduction and elongation than a correspondingly heat-treated steel without nickel, has more than enough increase in strength to make up for it; in other words, with a given strength the nickel steel will have a greater degree of toughness. Likewise, as we increase the strength of an alloy by means of nickel, the loss in reduction of area and percentage elongation is far below the loss secured when the strength is increased by increasing carbon content.

The effect of nickel upon the elastic limit and tensile strength of heat-treated steel varies with the amount of draw or temperature of reheat after quenching.

The following formulas represent the effect of 0.01 per cent of nickel upon a ¾-inch bar of steel; in these formulas *T* is the temperature of draw in degrees Cent., and the results represent the increase in pounds per square inch:

Elastic limit ..... 287—0.174*T*
Tensile strength ..... 294—0.214*T*

The reduction of area and percentage of elongation are reduced approximately the same amount, and this amount is not affected greatly by the temperature of draw; 0.01 per cent of nickel lowers the reduction of area and percentage of elongation about 0.0073 per cent in heat-treated steels. This slight amount is practically negligible for commercial nickel steel.

Nickel decreases the rate at which steel will absorb carbon in the carbonizing process. The amount of this is approximately 0.04 per cent for each 0.01 per cent of nickel.

Early Use of Permanent Iron Molds

How Ferromanganese, Ferrosilicon, Chills and Iron Molds Affect the Properties of Castings—In a Philadelphia Foundry Castings Have Been Made in Permanent Molds Since 1888

BY ALEXANDER E. OUTERBRIDGE JR.

IN comparatively recent years the microscope has supplemented chemical analysis and has given us much valuable information regarding the effect of heat treatment upon the structure of metals, especially iron and steel. The spectroscope also has shown us the signatures of all metals, written in fine lines of colored lights that cannot be imitated or disguised.

The specific gravity of alloys and the remarkable changes in density that may be effected by heat, as in the case of the extraordinary growth of gray cast iron when subjected to repeated heating and cooling* or the equally remarkable change in density caused by sudden cooling from the liquid to the solid state, as shown in the tread or periphery of a chilled cast iron car wheel, are subjects of great interest for study. These are but a few of the aids to the study of metals now available and a vast unexplored field yet remains for the future investigator. The difference between wrought iron, steel and cast iron, commonly is attributed mainly to the proportions of carbon, silicon, sulphur, phosphorus and manganese, together with a few other elements, composing these alloys, and the analytical chemist has no difficulty in determining the relative proportions of these elements with sufficient accuracy; but beyond this lies a region of which he knows nothing. He does tell us, it is true, that carbon exists in iron in two different forms, combined and graphitic, but how many other forms of carbon may there be united with these other elements?

We already know of three totally different forms of pure carbon, as follows: A soft, intensely black substance called lamp black which the chemist tells us is 100 per cent carbon; an intensely hard, transparent crystal, the diamond, also 100 per cent carbon and pure plumbago or graphite, an unctuous material, quite different from the other forms, also 100 per cent carbon. There is absolutely no chemical difference between them.

In like manner it is known that pure silicon exists in three distinct forms or amorphous conditions. So it is with some and probably all of the other elements combined with iron.

A number of cast iron test pieces made to illustrate an address which I delivered before the Franklin Institute in 1888 on "The Relation Between the Physical Properties and Chemical Constituents of Pig Iron" are shown in Fig. 1. These test pieces were cast from eight different melts of iron. The two upper rows were poured in green sand molds having an iron chill block on one face.

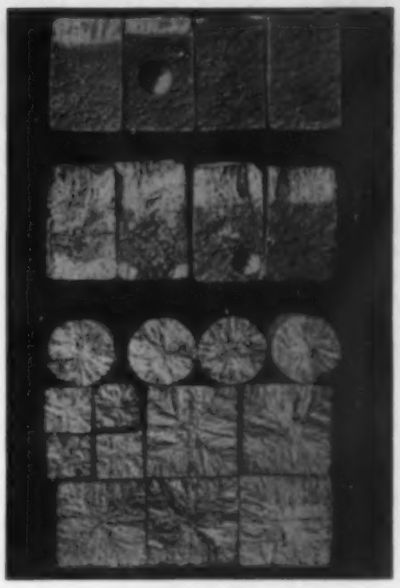


FIG. 1—FRACTURES OF CAST IRON TEST BARS

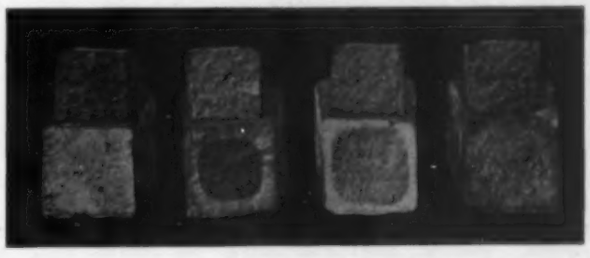


FIG. 2—SOFTENING EFFECTS OF FERROSILICON ADDED TO A LADLE OF MOLTEN METAL

The test bar at the right hand upper corner shows merely a skin chill on the part cast against the iron block; the next bar displays a little more chill and the other bars show increasing proportion of white iron on the upper faces and two show white iron on the lower faces also. Underneath the eight test pieces cast in sand, are nine square and four round test pieces, all *white iron*, showing very clearly that the crystals are always formed at right angles to the surface of the mold. These test pieces were cast in *iron molds* from the same ladles of iron as the other bars and it will be noted that all are equally white, notwithstanding the fact that the bars cast in sand with an iron chill block on one face vary enormously in depth of chill. These iron molds may be called *chill magnifiers*. I have used similar chill cups daily for detecting chilling properties in soft foundry irons for over 30 years, and they have proved to be of the greatest value in detecting chill that would not otherwise be suspected in such iron mixtures. The main difference in composition of the eight melts of iron shown in Fig. 1 was found to be in the relative proportions of silicon. The test piece showing a mere trace of chill has over 1.5 per cent silicon; the one showing the most chill has about 0.60 per cent silicon and the other test pieces contain silicon ranging between these extremes.

The manufacture of chilled cast iron car wheels, a purely American invention, to which the development of railways in this country may be said to owe their rapid progress in the early days and to which they are still largely indebted for freight traffic, was rendered possible by the practical application of the chilling property found in our cold blast charcoal irons, and its continued success

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Presented at the June meeting of the Philadelphia Foundrymen's association. The author is metallurgist, Wm. Sellers & Co., Inc., Philadelphia.

*Two bars of gray cast iron were displayed by Mr. Outerbridge, that were cast in one mold from one ladle and were both originally the same size, namely, 14⅛ x 1 x 1 inches. The specific gravity of the metal was 7.21, making 450 pounds to the cubic foot. One bar had been permanently expanded or caused to grow while in the solid form to 16½ x 1¼ x 1¼ inches, making an increase of 40.97 per cent. The specific gravity of the expanded bar is 5.64, making 350 pounds to the cubic foot. Other bars of gray cast iron have been caused to increase in cubical dimensions over 50 per cent by repeated heating and cooling, still retaining their metallic qualities.

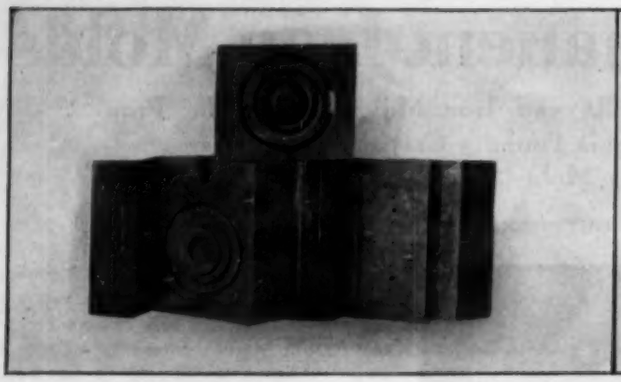

FIG. 3—AN IRON MOLD MADE IN 1903 AND THE CASTING IT PRODUCED

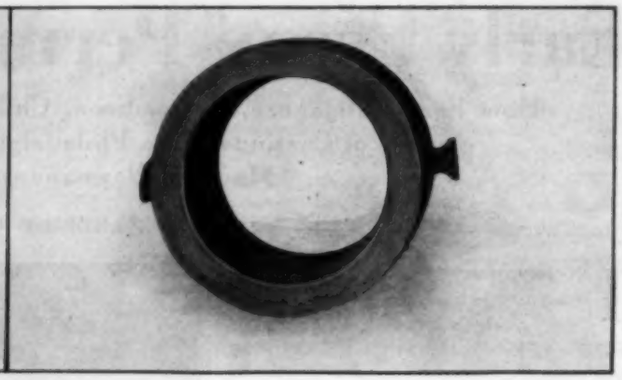

FIG. 4—IRON MOLD FOR A BUSHING OF A 42-INCH CAR WHEEL LATHE

today is dependent largely upon the skill of the chemist to simulate those natural qualities by other means, long after cold blast charcoal iron has gone out of existence.

My first investigation of this peculiar property of cold blast charcoal iron (and of some grades of anthracite and coke iron) dates back to 1876, when a fine exhibit of chilled cast iron car wheels at the Centennial exhibition first attracted my attention. One of the wheels was broken to show the fracture; the plate and brackets were dark gray, while the tread of the wheel was as white as silver. I learned that the white iron tread was formed by the sudden cooling of the metal cast against a heavy iron chill ring and that while the plate and hub of the wheel were quite soft, the tread was hard as steel.

White Metal Heavier Than Gray Iron

At that time I was making some specific gravity determinations of various metals in the assay laboratory of the mint, where I was an assistant, and samples of the white iron forming the tread of a wheel and of the dark gray iron forming the body were furnished to me for examination. I was astonished to find that the white metal weighed about 60 pounds to the cubic foot more than the gray iron portion of the same casting. This served to explain the abnormal cooling strains in a chilled casting of this character, necessitating prolonged annealing, or very slow cooling, to enable the molecules to adjust themselves gradually and thus relieve the strains.

These investigations led to others, and for a period of eight years I was daily engaged in the study of the metallurgy of chilled cast iron car wheels and their manufacture. It was customary to cast each day in the car wheel works where I was engaged as metallurgist a large variety of chilled car wheels ranging from full size, double-plate passenger and freight wheels, 33 inches diameter, street car wheels (usually of spoke pattern), down to small and light mine car wheels.

It was not possible to pour all of these from one mixture of iron, since the metal suitable for the heavy wheels was too high chilling for the smaller wheels. This necessitated melting soft iron every day in a separate cupola to mix in varying proportions with the regular iron in separate ladles.

To overcome this expense, if possible, by altering the character of the iron in individual ladles, after delivery from the cupola, a great many experiments were made (1880-4) with aluminum costing $8 per pound, spiegeleisen and 80 per cent ferromanganese, granulated or powdered, added in small quantity to the metal in the ladles.

Effects Produced by Aluminum and Spiegeleisen

The effects produced by aluminum and spiegeleisen were in the right direction though they were not sufficiently marked to be valuable, but it was then found that when powdered 80 per cent ferromanganese was added in the proportion of one pound to 600 pounds of iron, a most remarkable change was immediately produced in the character of the molten iron in the ladle. The first publication of these experiments was made in the address already alluded to, printed in the Journal of the Franklin Institute, March, 1888, and was as follows:

A remarkable effect is produced upon the character of hard iron (i. e., high chilling iron) by adding to the molten metal, a moment before pouring it into a mold, a very small quantity of powdered 80 per cent ferromanganese, say one pound in 600 pounds of iron. The result of several hundred carefully conducted experiments which I have made, enables

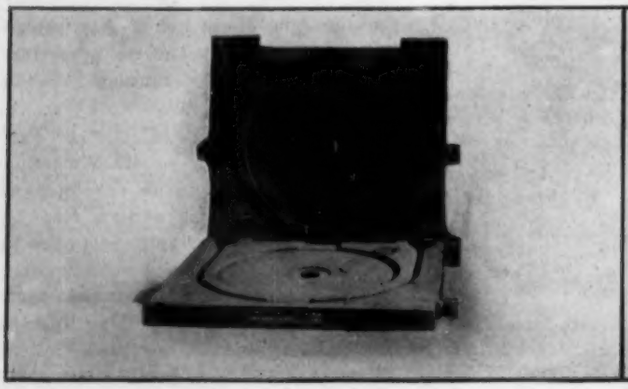

FIG. 5—AN IRON MOLD FOR A FRICTION DISC

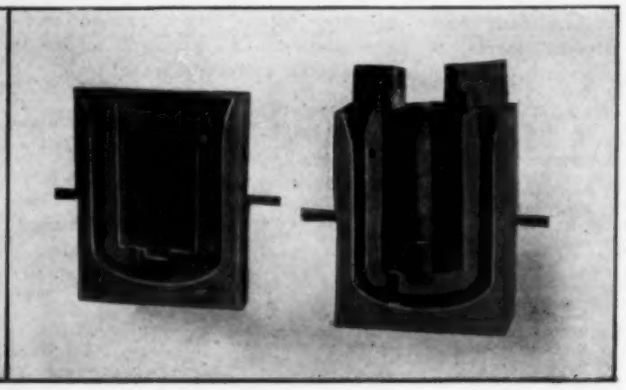

FIG. 6—IRON MOLD AND CORE FOR A SPIRAL PINION

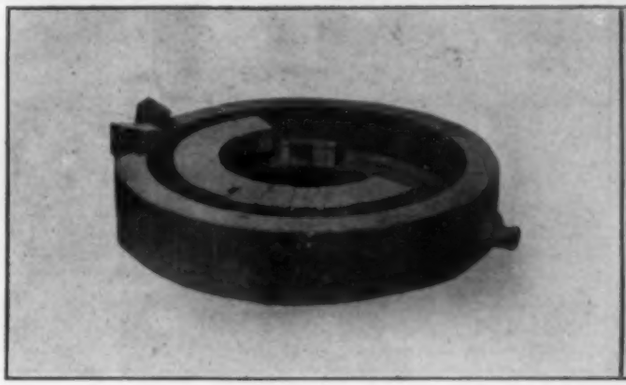

FIG. 7—IRON MOLD WITH A COLLAPSIBLE CENTRAL PORTION

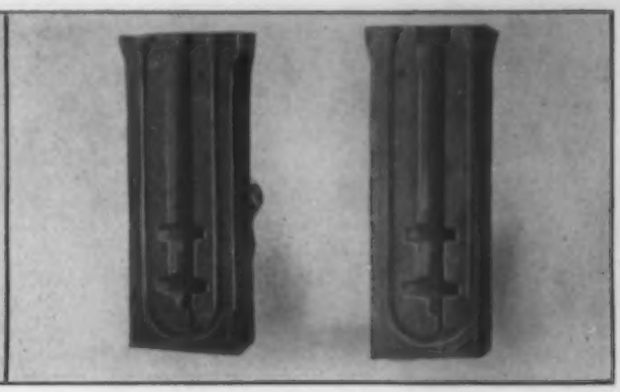

FIG. 8—IRON MOLD FOR SPINDLE OF A HORIZONTAL DRILL

me to say that the transverse strength of the metal is increased from 30 to 40 per cent, the shrinkage is decreased from 20 to 30 per cent and the depth of the chill is decreased about 25 per cent, while one-half of the combined carbon is changed into free carbon.

Prior to this time, manganese always had been regarded as a hardening element in cast iron and the surprising claim that when added in a ladle of high chilling car wheel iron it had an opposite effect at first met with incredulity, but in course of time its use became almost universal and I believe it still is used very largely in the manufacture of chilled cast iron car wheels. No application for patent rights was made for this process.

Ferromanganese Acts as Flux

Ferromanganese when added in powdered form to a ladle of molten car wheel iron acts as a deoxidizing and desulphurizing flux by reason of the strong affinity of manganese for oxygen and sulphur, but it is only efficacious when added to iron that is comparatively low in silicon, less than 1 per cent, and high in combined carbon.

It is absolutely useless, if not positively harmful, when added to foundry mixtures carrying over 1 per cent silicon and but little combined carbon, yet I know that 80 per cent ferromanganese has been sold to foundrymen for the treatment of their foundry iron mixtures during the time when the alloy could be bought for a few cents a pound. Its present price is prohibitive, except for special purposes.

The use of ferromanganese as a flux in ladles in car wheel manufacture is of enormous value to that industry; its abuse through ignorance or failure to understand its proper functions must have led to disappointment when added as a flux in ladles of foundry iron by those who do not understand or appreciate the radical difference between car wheel iron and foundry iron, whether soft or hard.

While the manufacture of chilled cast iron car wheels requires very accurate control of the chilling property of the metal, it is of far more uniform character than the iron needed for the great variety of castings, ranging from a few pounds up to perhaps 30 tons or over, that must be melted often in one day in the large machine tool works with which I am connected as metallurgist. It is customary, therefore, to group all the small work needing soft, ductile iron so that it will be cast near the beginning of the run of iron from the cupola; this is followed by a medium grade of iron for miscellaneous castings capable of being machined readily, but not too soft to give good wearing service; this again is followed by strong iron mixtures intended for large and heavy work requiring metal of high tensile and transverse strength.

Method of Changing Physical Properties

The importance of having some simple, cheap and reliable method of changing the physical properties of molten iron after it has been tapped from the cupola has been regarded as advantageous ever since the value of the method of modifying the chilling property of car wheel iron in individual ladles, by treatment with powdered ferromanganese, became well known. This led to the improper use of ferromanganese in ladles of foundry iron through ignorance of its proper functions.

As long ago as 1880 I made efforts in this direction with alloys of iron and silicon, but at that time the richest alloy obtainable contained less than approximately 20 per cent silicon.

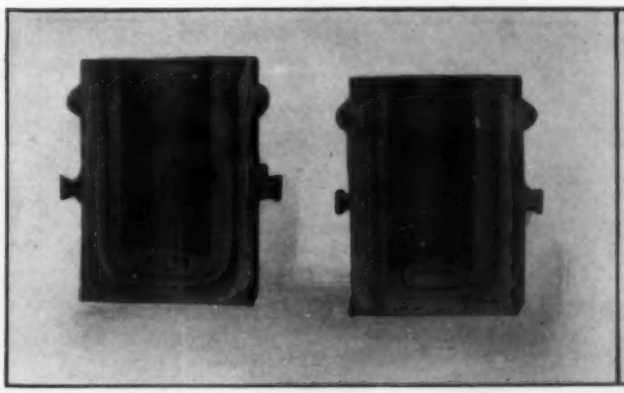

FIG. 9—IRON MOLD FOR A SPIRAL PINION OF A 174-INCH PLANING MACHINE

FIG. 10—AN IRON MOLD FOR A FLANGED BUSHING

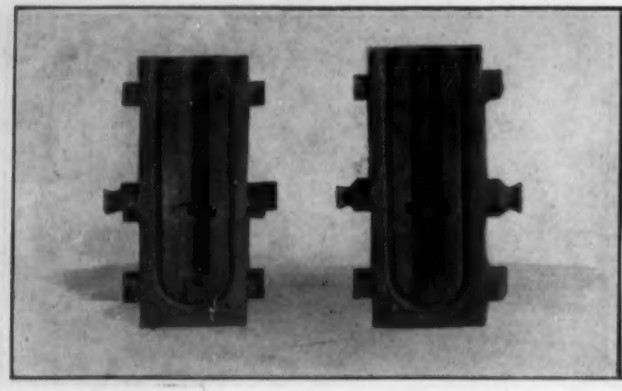

FIG. 11—AN IRON MOLD FOR A SPINDLE OF A RADIAL DRILL

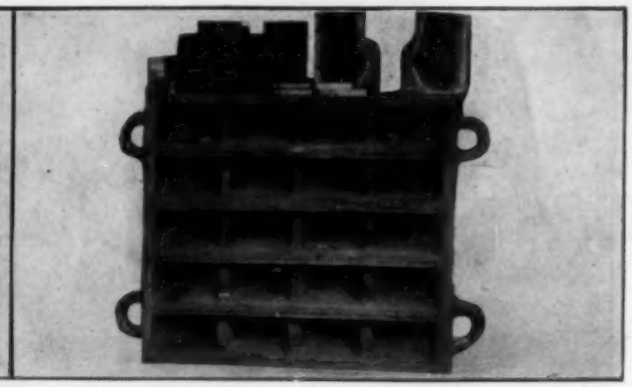

FIG. 12—AN IRON MOLD FOR OVER-PIG

In subsequent years 50 per cent ferrosilicon was produced in electric furnaces for use in steelmaking and these tests were then renewed with the results that have been already published, showing that the addition of a small quantity of the powdered 50 per cent ferrosilicon alloy in a ladle of molten foundry iron produces a remarkable effect upon it, by *softening* and at the same time *strengthening* the iron. This is quite an opposite effect to that produced by increasing silicon in the cupola, which always tends to weaken iron. The accompanying table shows the results of a few tests of this kind made in 1905 with ordinary foundry irons.

Softening Effects of Ferrosilicon

The effect of adding four ounces of powdered, 50 per cent ferrosilicon in a hard ladle holding about 25 pounds of molten iron, and of adding one pound to 200 pounds of iron in a ladle, upon the strength and deflection, as compared with the same iron untreated, is clearly indicated in this table.

The success of these initial tests led to more extended investigations. Fig. 2 shows the remarkable effect in reducing chill in foundry iron by adding thereto powdered 50 per cent ferrosilicon in different proportions in the ladle, ranging from 0.30 to 0.80 per cent of silicon. In Fig. 2, No. 1 shows the fracture of two test bars cast from a ladle of untreated iron. The upper piece was cast in green sand, 1 x 1 x 15 inches, and was an ordinary transverse test bar. The lower piece was cast in a heavy iron cup to cool the metal rapidly. The upper test piece is gray and is easy to drill. The lower one is perfectly white and cannot be drilled with an ordinary steel drill. No. 2 shows the fracture of two similar test bars poured from the same iron after the addition of 0.3 per cent of silicon in the form of 50 per cent ferrosilicon added in the ladle. Note the marked reduction in depth of chill in the sample cast in the iron cup. No. 3 shows the fracture of two similar test pieces from the same iron after adding 0.5 per cent silicon in the ladle. The chill is still further reduced. No. 4 shows the fracture of two similar bars from the same iron after adding 0.8 per cent silicon in the same manner. The chill in the sample cast in the iron cup is almost entirely absent.

The samples cast in sand are all gray, but there is an appreciable difference in the fracture, the treated metal showing considerably softer iron than the untreated sample. The metal which was selected for this particular test was comparatively low in silicon, consequently having comparatively high chilling property, but this fact would never be suspected from an examination of the fracture of the test sample cast in sand. Very few practical founders are aware of the large variation in chilling property of their iron, sometimes of presumably similar grades, melted on different days, or even of the wide variations which may occur in different portions of one heat.

Silicon Favors Formation of Graphite

In "The Metallurgy of Steel", by Henry M. Howe, the author refers to silicon as follows:

Iron absorbs silicon greedily, uniting with it in all proportions at least up to 30 per cent and apparently the more readily the higher the temperature, absorbing it even at a red heat when embedded in sand and charcoal. It diminishes the power of iron to combine with carbon * * * thus favoring the formation of graphite during slow cooling. It increases the fusibility and fluidity of iron; it lessens the formation of blow holes; by reducing iron oxide it apparently removes one cause of red shortness; it hinders at high temperatures the oxidation of iron and probably of the elements combined with it.

Here we have, I think, a practical

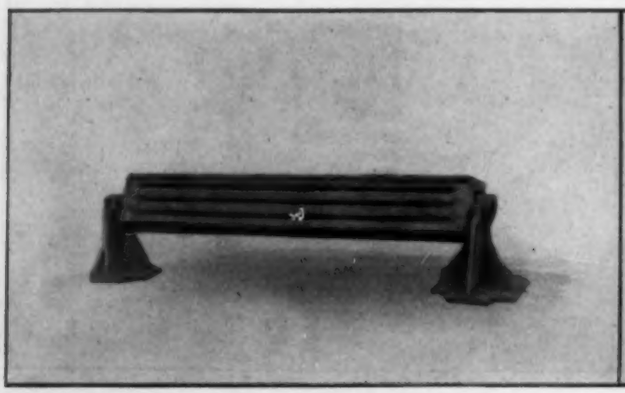

FIG. 13—IRON MOLD FOR CASTING LONG CORE RODS

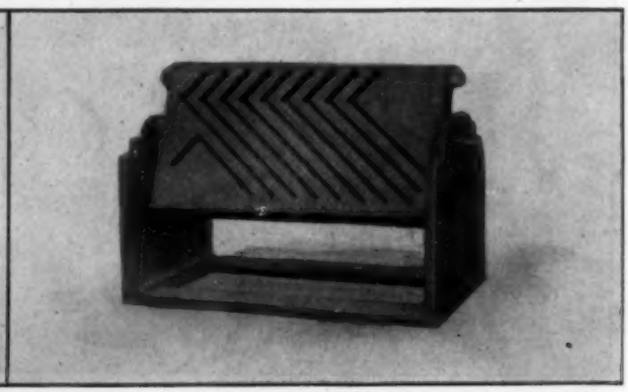

FIG. 14—CAST IRON MOLD FOR CASTING GAGGERS

solution of one great difficulty that heretofore has militated against the successful use of permanent iron molds for making castings that must be machined.

Since 1888, machinable castings have been made in the foundry of William Sellers & Co., Inc., in permanent iron molds and still are being so made. Through the courtesy of the president of that company I am now permitted to display illustrations of the original iron molds, still in use, together with some machinable castings that were made in them years ago. Also large and small molds of more recent manufacture. In fact, more than 100 permanent iron molds, ranging in weight from a few pounds up to 7000 pounds each, are in use in this country.

The main object of casting in iron molds is to secure machinable castings of exceedingly fine grain, free from dirt, sponginess or other defects, while at the same time having marked increase in strength.

An all-iron mold made in 1903 for a saddle for 36-inch planing machine, also one of the gray iron machinable castings, absolutely free from any skin chill made in this mold, are illustrated in Fig. 3.

This was a difficult casting to obtain free from surface defects on one or the other face, or from draw holes, when made in sand, but when cast in this iron mold, they were perfect and all the saddles subsequently produced, until a change was made in design, were cast in this iron mold.

Anticipating the question, "How do you prevent these molds from warping or growing so as to become useless?" I will say there are two distinct methods. The simplest method and the one we adopt is to make but one casting from one melt in one iron mold. In this way the mold never gets red hot so that it does not grow. The second method is to use low silicon iron for the molds, as metal of that character grows far less when repeatedly heated and cooled above a cherry red than soft foundry iron. Finally, castings made of white iron do not expand permanently when heated and cool sufficiently to overcome the original shrinkage of the metal, so that when practicable, permanent iron molds may be made of white iron. The accompanying illustrations show iron molds that have been made and used in the Sellers foundry for making machinable castings.

An iron mold for a bushing of a 42-inch car wheel lathe shown in Fig. 4. This bushing is 19 inches in diameter, 13½ inches deep and only 1 inch thick. The mold is 6½ inches thick and it has a collapsible iron core. The metal must be absolutely free from chill as the thin casting is turned inside and outside.

Results of Tests Following the Use of Ferrosilicon in the Ladle

Date	Amount of silicon used	Breaking strains, pounds	Deflection, inches	Resilience	Shrinkage inches	Per cent gain: Breaking strain, per cent	Per cent gain: Deflection, per cent	Per cent gain: Resilience, per cent
Oct. 10, 1905	¼-pound in hand ladle	2205	0.120	45.30	0.192			
		2155	0.112	40.09	0.191			
	Gain	110	0.008	5.21	.....	5.10	7.14	13.00
Oct. 11, 1905	¼-pound in hand ladle	2215	0.137	50.51	0.182			
		2165	0.124	44.60	0.185			
	Gain	50	0.013	5.91	.....	2.30	10.40	13.20
Oct. 14, 1905	¼-pound in hand ladle	2600	0.152	65.79	0.196			
		2055	0.116	39.18	0.188			
	Gain	545	0.086	26.61	.....	26.50	31.00	67.00
Oct. 15, 1905	¼-pound in hand ladle	2330	0.143	55.45	0.183			
		1893	0.110	34.00	0.183			
	Gain	437	0.033	20.85	.....	23.8	30.00	60.2
Oct. 16, 1905	¼-pound in hand ladle	2210	0.124	45.54	0.183			
		2120	0.112	39.44	0.185			
	Gain	90	0.012	6.10	.....	4.20	10.70	15.40
Nov. 13, 1905	1 pound in a 200-pound ladle	2370	0.139	54.76	0.186			
		2050	0.118	40.19	0.184			
	Gain	320	0.021	14.57	.....	15.60	17.80	36.20
Nov. 21, 1905	1 pound in a 200-pound ladle	2178	0.128	46.34	0.188			
		2000	0.119	39.60	0.182			
	Gain	178	0.009	6.74	.....	8.90	7.50	17.00

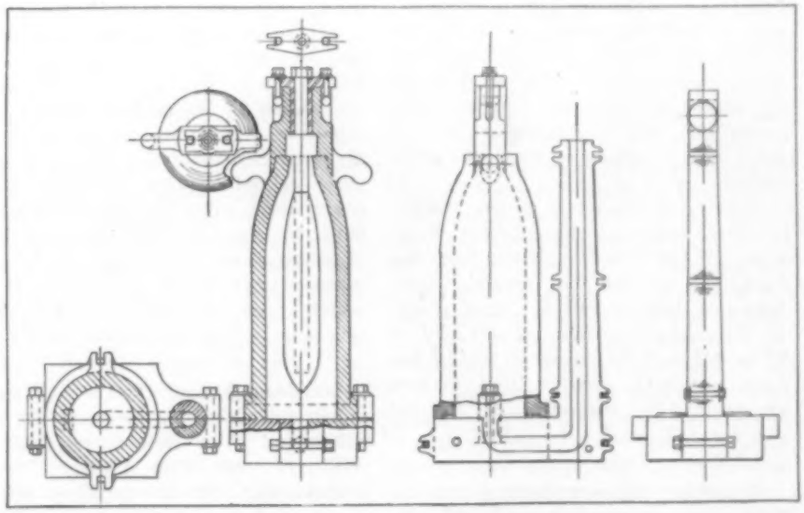

FIG. 15—AN IRON MOLD 30 INCHES LONG, FOR CASTING 10-INCH PROJECTILES

Fig. 5 is an iron mold for friction discs for dynamometer for the Pennsylvania railroad; these castings are 42 inches in diameter, are cast 1½ inches thick and are finished all over, ⅞-inch thick. The pull on the draw bar of the locomotive on this machine was originally 80,000 pounds, and was afterwards increased to 100,000 pounds. It was essential that these cast iron discs should be fine-grained and free from the slightest defects. After failing to procure satisfactory castings in sand molds they were cast without flaws in this iron mold. The casting was poured from the bottom.

The iron mold and core for a spiral pinion for a 36-inch planing machine are illustrated in Fig. 6. This has five teeth, 2 inches deep, cut from the solid metal. Semisteel was cast in this mold, free from chill. It was poured from the bottom.

Fig. 7 shows an iron mold with a collapsible central portion. This is the mold for a gear ring for a 42-inch car wheel lathe. Teeth are cut in the ring which is cast solid. The mold is cast open and semisteel is used. Over 100 rings have been cast in this mold. The blank ring is 5 feet in diameter, 8 inches deep and 6 inches thick.

An iron mold for the spindle for a horizontal drill is shown in Fig. 8. This mold is 5 feet long, 21½ inches wide and 18 inches thick. The core is 2½ inches in diameter and the metal of the spindle is 1¼ inches thick. The casting is poured from the bottom.

Fig 9 is an iron mold, 42 inches long and 28 inches wide, for a spiral pinion of a 174-inch planing machine. This has a solid iron core 7½ inches in diameter. The spindle is 30 inches long and 14½ inches in diameter. It has five teeth 2¼ inches deep cut

from the solid. The casting is poured from the bottom.

Fig. 10 is an iron mold for a flanged bushing for a 72-inch boring mill. The bushing is 15½ inches in diameter and the metal thickness is ¾-inch.

Fig. 11 is an iron mold for a spindle of a radial drill. The mold is 40 inches long, 16 inches wide and 12½ inches thick. The spindle is 4½ inches in diameter, has a 2-inch core and the metal is 1¼ inches thick. The mold is poured from the bottom.

An iron mold for *over-pig* is shown in Fig. 12. The molds were first made in 1880 and this one has been in daily use for many years. On top of the molds are two iron molds for lifting nuts for the crossheads of large boring mills. These castings must be made of very strong, fine-grained iron. Also on top of the molds are two test bars, originally of the same size, 14 13/16 x 1 x 1 inches cast in the same mold from one ladle of iron. One bar has been caused to *grow* or increase in size to 16½ x 1⅛ x 1⅛ inches, equivalent to 40.98 per cent enlargement.

Fig. 13 is an iron mold for casting long core rods. This has been in use since about 1890. It is so designed that it never warps. Many thousands have been cast in this mold.

A permanent mold of waffle iron design, mounted on trunnions for casting gaggers, is shown in Fig. 14. It has been in use since about 1890. It is so designed that it never warps. Many thousands of gaggers have been cast in this mold.

Fig. 15 is a drawing for an all-iron mold for casting 10-inch projectiles, 30 inches long. The mold was made in 1891. A number of gray iron castings were made in this mold and machined all over. They resembled steel projectiles in appearance. These projectiles were sent to Washington and pronounced the finest cast iron projectiles ever made, but about that time the authorities decided that steel alone should be used; hence, only 14 of these castings were made in this mold.

Buys Iron Mine

The Miami Metals Co., Chicago, has purchased the Zimmerman mine at Iron River, Mich., and will use and sell its products from now on. This mine was owned by the Spring Valley Iron Co. It was opened in 1908 and has shipped steadily for a number of years, forwarding 145,716 tons in 1916 and 108,217 tons in 1915. The Miami Metals Co. was formerly called the Miami Products Co. It manufactures manganese products, having leased one of the Iroquois furnaces, Chicago.

Refractories Rise

And Advances of $3 to $5 Generally Established—Deliveries Uncertain

Pittsburgh, June 26.—Virtually all manufacturers of refractories have advanced minimum quotations $3 to $5. Several makers of first quality firebrick in western Pennsylvania are quoting $48, while others are asking $53 per thousand as a minimum, and sales have been made between $55 and $60 for first quality. All manufacturers, however, have not withdrawn formally the $45 price, though they are selling little at that figure. Quotations on silica, magnesia and chrome brick are unchanged, although the tendency of prices is upward.

Demand continues exceedingly heavy. Several makers say they are declining to entertain bids on approximately 1,000,000 brick per week, on account of inability to meet specifications for delivery. Numerous inquiries for export are pending, but manufacturers generally are refusing to consider negotiations for shipment abroad.

Activity is reported in the market in New England where prices range from $55 to $65 for first grade and from $48 to $58 for second grade. Inquiries largely call for first grade. In Kentucky firebrick, an advance of $5 to $45 and $55 for first quality has been put into effect. Ohio makers are quoting the market unchanged and the demand good.

Refractories

(Per 1,000 f. o. b. works.)

FIRE CLAY BRICK.
(First Quality.)

St. Louis No. 1	$40.00 to 50.00
St. Louis High Grade	55.00 to 65.00
Pennsylvania	45.00 to 55.00
Ohio	42.00 to 47.00
Kentucky	45.00 to 55.00
New England	55.00 to 65.00

FIRE CLAY BRICK.
(Second Quality.)

Pennsylvania	$40.00 to 50.00
Ohio	35.00 to 37.00
New England	48.00 to 58.00

SILICA BRICK.

Pennsylvania	$50.00 to 60.00
Chicago	55.50 to 65.50
Birmingham	45.00 to 55.00

MAGNESIA BRICK.
(Per Net Ton.)

9 x 4½ x 2½	$135.00 to 145.00

CHROME BRICK.
(Per Net Ton.)

9 x 4½ x 2½	$125.00 to 135.00

BAUXITE BRICK.
(Per Net Ton.)

55 per cent	$40.00 base
76 per cent	100.00 base

A summer session in factory organization, cost accounting and scientific management will be held Aug. 2-18 at Pennsylvania State College, State College, Pa. The course is intended for industrial executives and department heads. The number of students will be restricted to 30. The course includes instruction in making time and motion studies, routing, scheduling order of work, and time and cost records.

Chian is Problem

Of the World, Says W. A. Rogers, Home From Far East

Better appreciation of the friendly spirit extended toward this country by the Japanese looking toward closer co-operation and of the capabilities and culture of that race is urged by William A. Rogers of Rogers-Brown & Co., upon his return to the United States after a four-months' tour of the Orient. The importance of the Chinese problem is emphasized in an interview published by a Buffalo newspaper. Mr. Rogers gives interestingly and at length his impressions of the Mongolian countries:

Speaking of the Chinese question, Mr. Rogers said:

"A large interchange of travel between our country and those across the Pacific is most desirable, with a view to getting acquainted with peoples with whom our destiny is intimately bound, whose national life we can no more ignore than we can the facts of the present war. China is the big problem of the world.

"The future peace of the world turns on the attitude and action of the United States and Japan regarding this problem during the next few years. A friendly co-operation of the two countries coupled with a firm insistence on our part for an actual open door, which, although existing in theory is in fact a door scarcely ajar, will save untold troubles for ourselves and other nations in the future.

"It is, for instance, crass provincialism for us to treat the Japanese as an inferior race. In many respects their civilization is better than ours. The Japanese people are better governed than the people of the United States; their school system is better than ours; their army is equal, man for man, to that of the Germans, and they excel us in physical hardihood, industry and good manners, all of which goes a long way to offset points in which we excel."

Doughten & Son, 41 South Fifteenth street, Philadelphia, have leased the mica schist and silica rock quarries of the William Penn Silica Works, Conshohocken, Pa. Mining operations will be commenced immediately.

British Rely Upon American Steel

Construction of Some New Capacity Suspended in Expectation of Greater Supplies from This Country—War Preparations Here Excite Satisfaction—General Wage Advance Among Iron Workers is Allowed

Bureau of THE IRON TRADE REVIEW,
Prince's Chambers, Corporation St.,
Birmingham, Eng., June 1.

STEEL is very scarce, largely on account of the decreased shipments from America, combined with the constant increase of war requirements, consequent upon the growth of the army. Practically, the only steel now coming from America consists of consignments of wire rods costing about £27 ($131.60) per ton. Nearly all the iron and steel made goes directly into war consumption. In addition to the large works, construction of which was arrested by the government recently as a direct result of the intervention of America, some of the smaller works also have been stopped, in view of the increased reliance now placed upon American supplies.

Dazzled by American Efforts

The report published this week of the magnificent help rendered by America during the seven weeks which have elapsed since she entered the war has given the greatest satisfaction here. There is something dazzling about the program for the construction of 3500 war aeroplanes, and the training of 6000 aviators this year. In iron trade circles the news received this week, through THE IRON TRADE REVIEW cable, that the government had arranged for the steel for 3,000,000 tons of ships, was very favorably commented upon.

In the Glasgow district as well as in Sheffield works extensions are practically constant. The whole of the output goes to the government with the exception of limited quantities to France and Italy. Tinplate workers of South Wales are as busy as they can be having regard to the small quantity of bars available. With steel mills otherwise engaged, and a tight hand on imports, the raw material available is not more than 40 per cent of the normal supply. The result of this is that makers will not book ahead, and are refusing orders. Prices have lately touched new records and are expected to go still higher. Business has been done recently at 33s ($7.92) for average plates for government requirements while for the small quantities sold outside 38s ($9.12) can easily be had Among wire makers certain classes of product have been advanced £5 ($24), bringing them in line with other advances in prices which continue to be announced in comparatively rapid succession.

Details have not yet come to hand relative to an advance of 2½ per cent in ironworkers wages just decreed by the midland wages board; but there is some satisfaction in a decided improvement in tonnage by the 17 selected firms. During March and April the increase was fully 10 per cent over that of January and February. The rise establishes new wage records, and brings the rate of puddling to the extraordinary figure of 18s ($4.32). This is the third wage advance of 2½ per cent this year. The result will be a considerable increase in the cost of production, but manufacturers are inclined to accept this, without applying for higher selling prices.

Most of the mills and forges restarted this week on Wednesday after the holiday, but a few are taking a day or two longer for further repairs, while the scarcity of fuel which is very seriously felt, is stopping others. At one of the largest foundries in the district, the management frankly told the ministry of munitions that certain material much wanted could not possibly be supplied, unless coal supplies were increased. The government office approached the laggard colliery with the result that coal consignments were soon finding their way to the foundry. The scarcity of coal continues to be a serious matter, and has been aggravated to some extent by the Whitsuntide holiday. The pressure upon the collieries from all directions is very great, and it is simply impossible to supply anything like the fuel which is urgently needed.

Members of the midland wages board have been advised of a new advance of 2½ per cent in ironworkers wages resulting from the rise in selling prices during March and April. This advance will take effect next week and will establish a new wage record. The matter is very seriously regarded by blast furnace operators who are still awaiting the decision of the ministry of munitions on their application for higher selling prices. Some smelters in the Midlands declare that they are losing money on every ton of iron produced. With the lapse of time, manufacturers are beginning to doubt whether the advance they so confidently anticipated may now be depended upon. The larger production of basic pig iron has correspondingly reduced the amount of ordinary material available, which has become rather scarce, while makers are not anxious in present circumstances for future business. In view of the strong demand all sales are based upon maximum figures.

In the Cleveland district business is strictly confined to small prompt parcels. All sales there are under strict allotment by a special committee, and business is done on the principle of, almost, day-to-day supplies. Warrant stock now is under 2000 tons. East Coast hematite is selling in small quantities, and there is scarcely any margin for private consumers after government requirements have been met. The blast furnace makers of Cleveland and Durham have asked for an additional war bonus to meet the increased cost of living. The offer of the employers to meet the position consists of a graded war bonus, but so far this has failed to give satisfaction. They now are urging suspension of work at the furnaces for 24 hours, with a view to hold mass meetings. There is a decided indisposition among Cleveland makers to discuss foreign business at present rates. The effort to start additional furnaces in the north-west of England has met with very limited success, owing to the difficulty of getting increased materials, and it is likely that, for the present, the 30 furnaces in operation will have to suffice.

Will Market New Type of Electric Furnace

The Booth-Hall Co., with offices at 565 West Washington boulevard, Chicago, has been formed by five former officers and employes of the Snyder Electric Furnace Co. to build electric furnaces and conduct an engineering and metallurgical business. C. H. Booth, formerly president of the Snyder Electric Furnace Co., is president and general manager; W. H. Booth, formerly vice president of the Snyder company, will be metallurgist; Julius R. Hall will be vice president and F. J. Sheldon will be secretary. W. D. Walker formerly sales manager for the Snyder Co., will have charge of sales for the new company.

Patents have been applied for on an electric furnace to be called the Booth-Hall. This is designed in three types, to operate one, two or three-phase to suit the metallurgical conditions of various plants. The company already has closed a contract for a 4-ton, 2-phase Booth-Hall furnace as the first unit in the plant of the Electric Steel Co., which has recently been organized.

Testing Society Enters Busy Week

Many New Specifications Up for Consideration—Also Numerous Old Standards Will Be Revised—Program Crowded to the Limit and Attendance Promises to Break Record

Atlantic City, N. J., June 26. (By wire.)—With early indication of a record-breaking attendance before the end of the week, the twentieth annual meeting of the American Society for Testing Materials was opened auspiciously today at the Hotel Traymore. Ten sessions are scheduled until the close, Friday night, three of which were held today. The program is crowded to the limit with a total of 64 pages and committee reports.

The activities of the standing committees, which always have been such a notable factor in the achievements of the society, have shown no abatement during the year. The new tentative standard specifications that will be considered during the week total 31 and 22 revisions in existing standards are proposed. In addition, four new standards that have been published two years as tentative will be adopted. During the year the list of standing committees has been increased by the creation of the committees on magnification scales for micrographs and on classification of technical literature concerning materials. The committee on cold-drawn steel has been discontinued as an independent committee and now is merged with the general committee on steel, of which it is a sub-committee. The designation of the committee on cast iron and finished castings has been changed to that on cast iron.

Tentative standard specifications for wrought iron pipe were submitted by the committee on wrought iron. As a result of joint meetings with the special committee of the Master Mechanics' Association, with a view to having uniform specifications for staybolt iron adopted by the society and the Master Mechanics' Association, the standard specifications for staybolt iron were extensively revised and were ordered published as tentative. The proposed Master Mechanics' specifications differ from the revised specifications of the society in the range of tensile test requirements which is from 47,000 to 52,000 pounds per square inch with a secondary requirement limiting any one lot of iron to a permissible variation of only 3000 pounds per square inch in tensile strength, whereas the revision recommends limits in the tensile strength to a flat range of from 48,000 to 52,000 pounds per square inch. The Master Mechanics' specifications also include requirements for manganese and phosphorus whereas the society's revision includes only a manganese requirement. As a result of the difficulty experienced in obtaining refined wrought iron bars in large sizes in accordance with the requirements of tensile strength of the standard specifications for refined wrought iron bars, the committee recommended a change in Section 4. This now provides that for flat bars to be reduced in width, a deduction of 1000 pounds per square inch from the tensile strength specified by the standard shall be made. The revision as suggested provides that for material over 4 square inches in sectional area, a reduction of 500 pounds per square inch from the tensile strength specified by the standard will be permitted for each additional

William H. Bixby, Noted Army Officer, New President of Testing Society

BRIG. GEN. WM. H. BIXBY, newly elected president of the American Society for Testing Materials, brings to that society a wealth of experience, gained by his long and adventurous career in the service of his country, and a comprehensive insight into technical problems acquired by actual contact.

General Bixby was born in Massachusetts in 1849 and was appointed to the United States military academy at the age of 20. He received his commission from the academy in 1873, and was delegated to Willet's Point, N. Y., where he served for two years. At the expiration of this period he returned to the military academy to become an instructor in engineering where he remained for four years. Following this came a long period of professional duty, including service at Willet's Point, where he was promoted to the rank of captain, Fort Macon, Fort Caswell and in Europe. In 1886 he was delegated to examine and report on the stability of buildings injured by the Charleston, S. C., earthquake, and shortly after this period he was given charge of Cape Fear bridge.

Photo by Harris & Ewing

BRIGADIER GENERAL WILLIAM H. BIXBY, ENGINEER CORPS, U. S. A.

General Bixby's most important consignment came in 1897 when he was delegated to a comparatively new branch of activity. At this period he was given charge of the river and harbor improvements of the entire Ohio from Pittsburgh to Cincinnati. From 1902 to 1904 he held a similar position on the St. Mary's river. He was made brigadier general and chief of engineers in 1910, retired from active service in 1913 and was again placed on the active list by special order of the President on May 21, 1917. General Bixby will be recalled in connection with a controversy between navigation interests and promoters in 1894. Promoters claimed a 3000-foot span across the Hudson river to be impossible while navigation interests took the opposite position. General Bixby's investigations resulted in favor of the latter. General Bixby is a member of many organizations including American Society of Mechanical Engineers, American Society for Labor Legislation and the International Congress of roads.

2 square inches and a proportionate amount of reduction for fractional parts thereof, provided that the tensile strength shall not be more than 3000 pounds per square inch below the requirements specified. The permissible variations proposed agree with the practice of the specifications of the U. S. Navy and the Pennsylvania Railroad Co. Tentative specifications for wrought iron rolled or forged blooms and forgings for locomotives and cars were ordered printed as tentative.

Preparation of Micrographs

The tentative definitions and rules governing the preparation of micrographs of metals and alloys aim at standard practice in this branch of metallography. These provide for standard magnifications for making micrographs of steel and ferrous materials of 50, 100, 250 and 500. The standard magnifications for micrographs of nonferrous metals shall be 25, 75, 150 and 250. Lenses are specified and grain size is defined. The standard also contains recommendations regarding the preparation of micrographs for use by the society.

A number of changes were made in the specification covering the standard methods of testing. A sub-committee on effect of form and size of test piece stated that the problem on which it now is working may be summarized as follows: The results of tension tests of specimens are affected to some extent by the form and size of the test piece, especially the elongation at rupture. Considerable experimental study has been given to the effect of form and size of test piece by foreign laboratories, and standard proportions for test pieces have been proposed. The short tension test pieces used in American practice differ from the forms of specimens used abroad and it is desirable to correlate the results of tension tests made on these short specimens with the results of tension tests on longer specimens.

New Soil Pipe Specifications

Tentative specifications for soil pipe and fittings and for railroad malleable iron castings were submitted by the committee on cast iron, of which Richard Moldenke is chairman. The committee reported that the constantly increasing sulphur content of gray iron castings has resulted in a demand for more latitude in this direction in the specifications of the American Society for Testing Materials. Therefore, it was decided to report to increase the maximum sulphur limit in light castings from 0.08 to 0.10 per cent. The change from general to special standard specifications for malleable iron castings predicted last year, has arrived sooner than has been expected. The revised specifications adopted in 1915 did not satisfy the demand for all classes of malleable castings. The committee of the society, in co-operation with a similar committee of the American Foundrymen's association has prepared proposed specifications for railroad malleable and a recommendation was made that the present specifications be retained for the general run of work. The special requirements for conveyor chain links will next be taken up.

A. A. Stevenson, president of the Standard Steel Works Co., Philadelphia, in his presidential address to the society, chose for his subject "Our Society". He traced the development of the organization historically, and outlined its problems and achievements since its formation in 1898. He spoke of the improved relations between producers and consumers in the preparation and adoption of standard specification.

"There has been a marked change in the methods of work in committees, and even more perhaps in the spirit in which the work is carried on," said Mr. Stevenson. "In the early years when a specification was proposed the first step would be to tabulate all the important existing specifications and then to build up from such tabulations. When that stage was reached, the struggle began between the consumers on one side and the producers on the other; the consumers making every effort to get as much as possible; the producers to yield as little as possible. Both parties had certain reasons for their action, the consumers feeling that the producers were unreasonable, the producers feeling that no matter what was conceded some of the consumers would afterward try to force further concessions in drawing their own specifications. That this feeling of antagonism has largely disappeared should be a source of great encouragement in looking toward the future. Both

"Proof Testing" in the Future

"As to the future, I shall attempt to give only a few of the thoughts that have occurred to me in connection with the development of our work. It seems to me one of the developments of the future will be the increased testing of individual parts; that is to say, so-called "proof testing". As distinguished from the ordinary method of representative testing, it means that individual parts are tested and subsequently used. For example, heat-treated axles and boiler tubes are tested in this way. If called upon to explain the difference between proof testing and representative testing, we might say in the first case the object is to determine what can be used; in the second, what cannot be. For some materials it is not easy to see how a method of proof testing can be worked out practically; for others it would appear feasible.

A tendency that is strongly in evidence today is one towards closer co-operation between the various technical societies, just as there is today in business a tendency toward co-operation in the broadest and best sense of the word. Indeed I shall look forward to the day when we shall have one general engineering society, made up of the various societies as members, their individuality maintained, but the work so correlated as to give greater efficiency and better results."

Officers for the ensuing years were elected as follows: President, W. H. Bixby, brigadier-general United States army, Washington, D. C.; vice president, Edward Orton Jr., dean of the College of Engineering of Ohio State university and state geologist of Ohio, Columbus, O. Members of the executive committee: J. A. Capp, chief of the testing laboratory, General Electric Co., Schenectady, N. Y.; W. F. M. Goss, president, Railway Car Manufacturers' association, New York; Wm. M. Kinney, inspecting engineer, Universal Portland Cement Co., Chicago, and C. D. Young, engineer of tests, Pennsylvania railroad, Altoona, Pa.

Call to Patriotism

WITH character as with materials, there are elements to be avoided, as well as those that are necessary to best fit us for the service demanded. Much is demanded from the nation and the individual in the present crisis. As a nation and as individuals, should we not make every endeavor to keep down the phosphorus of selfishness and the sulphur of hate? Then tempered by the carbon of charity, solidified by the silicon of hope, purified by the manganese of faith, strengthened by the alloy of patriotism, let us go forward! We know not what the future may have in store; let us be prepared to give of self and service and to make any sacrifice that may be necessary; confident that "right, not might", will prevail; confident of victory—not a victory of conquest and aggression, but a victory for democracy and civilization; confident that our nation will meet the calls made upon it and come through the ordeal sobered and chastened, with higher ideals, both national and individual.——President Stevenson in annual address.

Show Keen Interest in Boston Show

Number of Manufacturers Applying for Exhibitor's Space Indicates 1917 Show of Foundry Equipment and Machinery Will Surpass Previous Exhibitions—Tentative Technical Program is Announced

WITH the total number of applications for space in Mechanics' building already in excess of the number of exhibitors at Atlantic City two years ago, and with the approximate floor area reserved considerably in excess of that occupied during that show, the success of the exhibition of foundry equipment and supplies, machine tools and accessories, to be held at Boston, Sept. 25 to 28, is assured. Indications now point to the greatest show of this kind ever held and it is probable that in number of exhibitors all records will be broken.

Manufacturers who have reserved space now are making preparations to ship their exhibits at an early date to avoid delays in delivery due to the congested condition of the railroads. As soon as delivered, all equipment will be stored in Mechanics' building until the date of the opening of the show. An added feature of the exhibit will be the display of motor trucks. Manufacturers of these vehicles have been extended an invitation by the exhibition committee of the American Foundrymen's association to display their products and a representative number of types undoubtedly will be displayed.

GENERAL TOPICS

Symposium on "Military Stores"

"Making Shells in Permanent Molds," by Edgar A. Custer, Philadelphia.

Paper on Military Stores, by Dr. F. C. Langenberg, Watertown Arsenal, Watertown, Mass.

"Small Steel Castings for Ordnance Purposes," by Major C. M. Wesson, Watertown Arsenal, Watertown, Mass.

Symposium on "Refractories"

"Refractory Materials Employed in the Metallurgical Industries," by H. C. Arnold, University of Illinois, Urbana, Ill.

"Cupola Refractories," by G. E. Jones, Whiting Foundry Equipment Co., Harvey, Ill.

"Factors Contributing to the Economical Use of Grinding Wheels in the Foundry," by Wallace T. Montague, Norton Co., Worcester, Mass.

"Results of Tests in Blending and Mixing Sand by Means of Mullers," by R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston.

"Experiences with Sand Mullers from their Conception to Their Final Application to the Foundry Industry," by P. L. Simpson, National Engineering Co., Chicago.

"Fillet-Sizes," by Frank E. Jones, University of Kansas, Lawrence, Kans.

"Sand Blasting," by H. L. Wadsworth, Sand Mixing Machine Co., Cleveland.

"Efficiency in the Foundry," by Jas. A. Fitzgerald, Reno, Pa.

"The Metals of Technology," by John Ritchie Jr., Mass. Institute of Technology, Boston.

"Welfare Work in Southern Foundries," by J. F. Kent, American Cast Iron Pipe Co., Birmingham, Ala.

"Co-Operative Shop Training," by W. B. Hunter, Industrial Department, Fitchburg High School, Fitchburg, Mass.

"Scientific Selection of Men," by Wm. Judson Kibby, Cleveland.

"Co-Operation," by Chicago Foundrymen's Club.

"The Labor Situation as Relating to Co-Operation Between the Employer and the Employe," by G. E. MacIlwain, Babson's Statistical Organization, Wellesley, Mass.

"The Relationship of the Engineering Department to the Pattern shop and Foundry," by F. J. McGrail, Struthers-Wells Co., Warren, Pa.

GRAY IRON

"Seasoning Gray Iron Castings," by L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I.

"The Foundry from the Viewpoint of the Sales Engineer," by H. R. Atwater, Osborn Mfg. Co., Cleveland.

"The Effect of High Sulphur in Agricultural Machinery Castings," by T. Mauland, International Harvester Co., Chicago.

"The Use of the Microscope in the Foundry," by R. J. Anderson, Cleveland Metal Products Co., Cleveland.

"Modern Centrifugal Cupola Blowers," by J. W. Shugg, General Electric Co., Schenectady, N. Y.

"Making Small Cores Under Economical Conditions," by R. E. Kennedy, University of Illinois, Urbana, Ill.

"Effect of Cupola Practice on the Quality of Iron," by G. S. Evans, Lenoir City, Tenn.

"Briquetting Foundry Borings," by A. L. Stillman, General Briquetting Co., New York.

"Effect of the Presence of Iron Oxide in Molding Sand," by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"Machine Made Cores," by Lewis G. Blunt, Romeo Foundry Co., Port Huron, Mich.

MALLEABLE IRON

"Waste Heat Boilers as Applied to the Malleable Melting Furnace," by A. W. Pratt, Babcock & Wilcox, New York.

"The Application of Pulverized Coal to the Malleable Melting and Annealing Furnace," by Jos. Harrington, Chicago.

"Application of Waste Heat Boilers to the Malleable Melting Furnace," by C. D. Townsend, Danville Malleable Iron Co., Danville, Ill.

"Strength of Malleable Iron," by Prof. Enrique Touceda, Albany, N. Y.

"Application of Pulverized Coal to the Malleable Melting Furnace, by W. R. Bean, Naugatuck Malleable Iron Works, Naugatuck, Conn.

"Malleable Iron Annealing; Comparative Carbon Losses, Muffle vs. Pot Oven," by J. B. Deisher, T. H. Symington Co., Rochester, N. Y.

"Troubles Encountered in Machining Malleable Iron; Causes and Remedies," by A. T. Jeffery, Dayton Malleable Iron Co., Dayton, O.

STEEL

"Molding and Casting Large Slag Pots," by C. J. McMahon, Illinois Steel Co., Chicago.

"Recent Progress in the Application of the Electric Furnace to the Melting Problem," by C. H. Booth, Snyder Electric Furnace Co., Chicago.

"Discussion of Electric Furnace from Central Station Standpoint, with discussion of Power Rates and Measuring Power on a Maximum Demand Basis," by E. L. Crosby, Detroit Edison Co., Detroit.

"Data on Treatment of Cast Iron in the Electric Furnace," by Jos. L. Dixon, John A. Crowley Co., Detroit.

"Description of a Small Open Hearth Furnace," by David McLain, Milwaukee.

"Welding," by M. Stuart Plumly, Davis-Bournonville Co., Boston.

"The Use of Vanadium in Steel Castings," by J. Lloyd Uhler, Union Steel Castings Co., Pittsburgh.

"Report of Committee on Steel Foundry Standards," by W. A. Janssen, chairman, Bettendorf Co., Bettendorf, Iowa.

"Comparison of Electric Furnace and Steel Converter for the Manufacture of Small Steel Castings," by C. R. Messinger, Sivyer Steel Casting Co., Milwaukee.

"A New System of Burning Crude Oil," by W. A. Janssen, Bettendorf Co., Bettendorf, Iowa.

Technical Program

That the technical features of this great gathering of foundrymen have not been neglected is reflected by the 44 papers that already have been secured and to these must be added a large number of committee reports. The Boston meeting will be opened on Tuesday morning, Sept. 25, in place of Monday afternoon, as at Cleveland last year, and morning sessions only will be held, closing Friday, Sept. 28. Simultaneous sessions for the consideration of papers on gray iron, steel and malleable iron will be necessary to dispose of the lengthy program that has been prepared. Registration will open at the Copley-Plaza on Monday morning, but on Tuesday the headquarters will be transferred to Mechanics' building, where they will be continued throughout the remainder of the week.

Ajax Metal Co., Philadelphia.
Albany Sand & Supply Co., Albany, N. Y.
American Foundry Equipment Co., Cleveland.
American Gum Products Co., New York.
American Lighting Co., Chicago.
American Molding Machine Co., Terre Haute, Ind.
Arcade Mfg. Co., Freeport, Ill.
Armstrong Cork & Insulation Co., Pittsburgh.
E. C. Atkins & Co., Indianapolis.
Ayer & Lord Tie Co., Chicago.

B. & B. Mfg. Co., Indianapolis.
Beaudry & Co., Boston.
Berkshire Mfg. Co., Cleveland.
S. Birkenstein & Sons, Chicago.
Chas. H. Besly & Co., Chicago.
Blystone Mfg. Co., Cambridge Springs, Pa.
Brass World Publishing Co., New York.

Brown Specialty Machinery Co., Chicago.
Buckeye Products Co., Cincinnati.
Bullard Machine Tool Co., Bridgeport, Conn.
Carborundum Co., Niagara Falls, N. Y.
Cataract Refining & Mfg. Co., Buffalo.
Champion Foundry & Machine Co., Chicago.
Frank D. Chase, Chicago.
Chicago Pneumatic Tool Co., Chicago.
Chisholm-Moore Mfg. Co., Cleveland.
Cincinnati Pulley Machinery Co., Cincinnati.
Cleveland Blow Pipe & Mfg. Co., Cleveland.
Cleveland Milling Machine Co., Cleveland.
Cleveland Pneumatic Tool Co., Cleveland.
Thos. E. Coale Lumber Co., Philadelphia.
Cutter & Wood Supply Co., Boston.

Davis-Bournonville Co., Jersey City, N. J.
Debevoise-Anderson Co., New York.
Joseph Dixon Crucible Co., Jersey City, N. J.
G. Drouve Co., Bridgeport, Conn.

Federal Foundry Supply Co., Cleveland.
Felt & Tarrant Mfg. Co., Chicago.
Forbes & Myers, Worcester, Mass.

Gardner Machine Co., Beloit, Wis.
General Electric Co., Schenectady, N. Y.
General Fire Extinguisher Co., Providence, R. I.
Goldschmidt Thermit Co., New York.
Great Western Mfg. Co., Leavenworth, Kans.

Harrison Supply Co., Boston.
Herman Pneumatic Machine Co., Pittsburgh.
Hill, Clarke & Co., Boston.
Hoevel Mfg. Corp., New York.
Herman A. Holz, New York.
International Molding Machine Co., Chicago.
The Iron Age, New York.

Jennison-Wright Co., Toledo, O.
T. P. Kelly & Co., New York.
Julius King Optical Co., Chicago.
Lewis-Shepard Co., Boston.
David Lupton's Sons Co., Philadelphia.
Lynd-Farquhar Co., Boston.

McCrosky-Reamer Co., Meadville, Pa.
McLain's System, Milwaukee.
MacLean Publishing Co., Toronto, Ont.
Malleable Iron Fittings Co., Branford, Conn.
Metal Industry, New York.
Michigan Smelting & Refining Co., Detroit.
Midland Machine Co., Detroit.
Monarch Engineering & Mfg. Co., Baltimore.
Mott Sand Blast Mfg. Co., Brooklyn, N. Y.
E. H. Mumford Co., Elizabeth, N. J.
Mumford Molding Machine Co., Chicago.

National Engineering Co., Chicago.
New England Coal & Coke Co., Boston.
New Haven Sand Blast Co., New Haven, Conn.
Wm. H. Nichols Co., Brooklyn, N. Y.
Norma Co. of America, New York.
Norton Co., Worcester, Mass.

S. Obermayer Co., Chicago.
Osborn Mfg. Co., Cleveland.
Oxweld Acetylene Co., Newark, N. J.

Pangborn Corporation, Hagerstown, Md.
J. W. Paxson Co., Philadelphia.
Penton Publishing Co., Cleveland.
Pickands, Brown & Co., Chicago.
Pittsburgh Crushed Steel Co., Pittsburgh.
Portage Silica Co., Youngstown, O.
Henry E. Pridmore, Chicago.

Quigley Furnace Specialties Co., New York.

Railway Mechanical Engineer, Chicago.
Richey, Browne & Donald, Maspeth, N. Y.
Rivett Lathe & Grinder Co., Brighton, Boston.
Robeson Process Co., New York.
Rogers, Brown & Co., Cincinnati.

Sand Mixing Machine Co., New York.
Simonds Mfg. Co., Fitchburg, Mass.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
W. W. Sly Mfg. Co., Cleveland.
R. P. Smith & Sons Co., Chicago.
Werner G. Smith Co., Cleveland.
Standard Equipment Co., New Haven, Conn.
Strong, Kennard & Nutt Co., Cleveland.
Sullivan Machinery Co., Chicago.

Thomas Iron Co., Boston.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

United States Graphite Co., Saginaw, Mich.
U. S. Molding Machine Co., Cleveland.
United States Silica Co, Chicago.

J. D. Wallace & Co., Chicago.
Warner & Swasey Co., Cleveland.
Wheeler & Holcomb Co., Chicago.
White & Bro., Philadelphia.
Whitehead Bros. Co., Providence, R. I.
Whiting Foundry Equipment Co., Harvey, Ill.
E. J. Woodison Co., Detroit.

Obituaries

RALPH S. GREENLEE, who died recently at Chicago, had an extensive connection with the foundry industry of Chicago and the middle west. With his twin

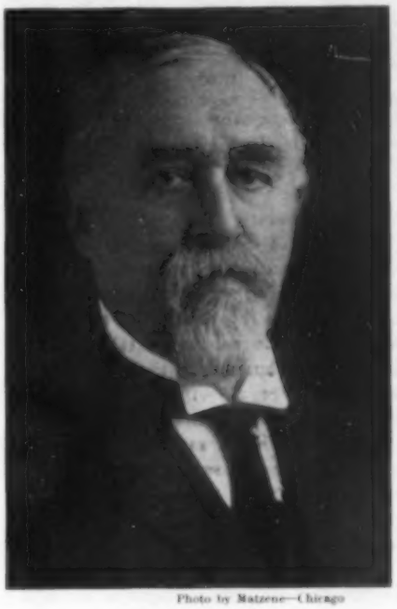

Photo by Matzene—Chicago
R. S. GREENLEE

brother, Robert L. Greenlee, who died Sept. 28, 1915, he organized and successfully developed various enterprises including the Greenlee Foundry Co. and the Northwestern Foundry Co., both of Chicago, makers of gray iron castings, and the Northwestern Stove Repair Co., the largest manufacturer of stove and furnace parts in the country. Mr. Greenlee at the time of his death was president of these three companies. The careers of the two brothers began on a farm in Crawford county, Pa., April 13, 1838. They continued to reside there until early manhood. When oil was discovered on Oil Creek near their home, they furnished barrels to Drake, the original producer. In 1862 they moved to Chicago and engaged in the manufacture of cooperage. The formation of the partnership of Greenlee & Co., for the manufacture of woodworking machinery was formed. Later this partnership took in car shop equipment and machine tools. The plant now is located at Rockford, Ill. The iron foundry enterprises were first undertaken in 1882.

George A. Rawlins, manager of the transfer department of the National Lead Co., died recently at his home in Roseville, N. J., aged 64.

John C. Clifford died recently at Chicago, aged 70 years. He had been associated with the L. Wolff Mfg. Co. as vice president and general manager for 45 years, three years ago.

Frederick W. Whitemore, manager of the Atlas Steel Column Mfg. Co., New York, died of blood poisoning at the Williamsburg hospital, recently. Mr. Withermore was 48 years of age.

Sidney Wilmot Winslow, president of the United Shoe Machinery Corp., Beverly, Mass., died at his home in that city recently, aged 64. Mr. Winslow was president of the United Awl & Needle Co. and the Campbell-Bosworth Machinery Co. and was interested in numerous other companies.

James M. Crafts, a distinguished scientist and president of Massachusetts institute of Technology from 1898 to 1900, died at his summer home at Ridgefield, Conn. Professor Crafts was a recognized leader in research work and was a member of several scientific societies.

W. Scott McCombs, veteran blast furnace manager of the Mahoning valley, died recently at his home in Youngstown, O., after prolonged illness, aged 78 years. In the late sixties he became manager of the Struthers, O., blast furnace where he remained ten years, and for the following 27 years he was superintendent of the Lowellville, O., stack.

Federal Price Fixing Being Urged

Numerous Investigations Into Cost of Production of War Materials Including Iron and Steel May Bring Forth Co-ordinated Plan—Trade Commission Begins Wholesale Probe For Navy—President Against Commandeering

WASHINGTON, June 26.—Activities of the legislative and executive branches of the government during the past week have had a disquieting effect upon business interests of the country. Farreaching plans looking to the control of prices of war requirements of all kinds have been initiated. Not only is the fixing of prices contemplated but it is also proposed, if authorities consider it necessary, to commandeer industrial plants of all kinds, those of the steel industry included. Radicals of the administration, and one branch of the government, the federal trade commission, have already recommended that commandeering be done at once. The President and the controlling element in congress, however, appear to be opposed at this time to resort to the taking over of private plants engaged in war orders. Power to do that now exists by legal provision, such as that in the urgent deficiency bill which relates to the merchant shipbuilding program, but despite reports and published accounts to the contrary, there seems to be little likelihood that it will be exercised to any great extent, at least unless there arises provocative circumstances, which so far have not asserted themselves.

A brief summary of what has been done and is under way nevertheless may be recited to show how the government has taken hold of the industrial situation with a view to taking firm hold of the matter of controlling prices and, if necessary, to take over private establishments.

What Has Been Proposed

A list of measures with that end in view follows:

The federal trade commission, at the request of Secretary of the Navy Daniels has begun a wholesale investigation as to the cost of producing iron ore, coal, oil, copper, cement, and other products. This is believed to portend, among other things, an investigation by the trade commission as to the cost of the complete process of steel manufacture.

Announcement was made by Senator Newlands, chairman of the committee on interstate commerce, that it will begin a hearing today on the Pomerene bill, supported by the President, to inquire into the coal situation and fix prices for that commodity, and that this investigation will lay the groundwork for another inquiry looking into the prices of steel, copper, iron ore, and other "basic" metals. This latter investigation will be in response to a growing sentiment in congress reflected in various measures which have been introduced. One, offered by Senator Borah as an amendment to the food control bill, calls for the fixing of prices of steel, coal, oil, farm implements, etc. Another measure, offered by Senator Cummins, called for fixing the prices of railroad materials of all kinds.

Chairman Denman of the shipping board, in his controversy over the prices of steel plates, shapes and bars for the shipbuilding program, has asked the federal commission to investigate the cost of producing these products, pig iron, iron ore, steel rails, ferromanganese, limestone, and all other materials involved in the manufacture of steel. Coupled with this request, Mr. Denman has also made the suggestion that the trade commission name prices for the products consumed by the government and to fix similar prices for the general public.

The federal trade commission submitted a report to congress recommending that the government take over rail and water transportation lines, coal mines and coke producing plants.

It will be observed from this outline that the investigations begun and proposed are of an overlapping character, and indications appear to be that they will revolve themselves into a co-ordinated plan by which the trade commission or the recently established cost accountancy bureau of that organization will take over all of the work for the entire government and report its findings. There is no escaping the fact, in view of the recommendations of the commission that the government take over coal mines, coke producing plants and rail and water lines, that lack of confidence in the business interests underlies the proposal. There is a feeling however that the President and perhaps the majority of his advisers will stand out against the adoption of any sweeping policy which may result in the depression of private industry and undue governmental interference tending to paralyze the machinery being built up to conduct the war.

Considerable interest has been manifested in the investigation started by the trade commission at the request of Secretary Daniels into the cost of producing iron ore and other commodities. Apparently it is the secretary's intention to have the commission investigate the cost of each process of steel manufacture. The fact that the navy department, or any other branch of the government, does not purchase iron ore, makes it plain that data showing the cost of producing this commodity would mean nothing unless it was accompanied by information showing the cost of producing finished products that the government does purchase. Therefore it may be that this investigation will be merged with the several others proposed.

The more radical element is of the opinion that the investigations are necessary to bring about an "economic readjustment" relating to the purchase by the government of supplies, both in peace and war times. While this is obviously no time to inaugurate "economic readjustments", there are those who sincerely feel that a careful and accurate investigation looking to the fixing of prices of war supplies would have a wholesome effect. They contend that not only would it bring about close understanding between the government and private business, but it would also do away with politics, which, it is plain, has been projected into the entire price situation. There is a belief that if the commission's findings showed the costs were higher than those expected by either Mr. Daniels or Mr. Denman the latter would resort to their old practice of asking that supplies be purchased at arbitrary and low figures named by themselves.

May Use Tentative Prices

The huge task of making such sweeping investigations as the trade commission has begun or is proposed would necessarily involve a long period of time. This has led to speculation as to whether it would be the policy of the government to make purchases upon a basis of tentative prices or whether it would endeavor to name its own figures. Doubt is expressed that the President would approve of the latter plan, although he is understood to be becoming increasingly convinced that vigorous action must be taken to fix prices of war supplies.

In connection with the investigation he asked the commission to make as to the cost of producing ore, coal, copper, etc., Secretary Daniels said that under the law the President is authorized to fix a reasonable price for what is needed for the navy, but he insisted that "there is no disposition to cause any hardship to the producers." He contended that the department intends to pay them a fair, "even a liberal profit, but we will not pay exorbitant prices, such as are being quoted in some instances."

Mr. Daniels conceded that it is difficult to determine the cost of production of any industry, because it varies so widely with different companies, but

said that this is a problem which is being worked out by the commission, "which will not primarily recommend prices, but will give the cost of production as the basis for fixing the rates to be paid for supplies for the navy." When the commission has made its report on the cost of production, he added, a "reasonable" profit will be added and the price will be fixed, after full knowledge of costs, in accordance with authority conferred by congress.

President Tells Goethals to Go Ahead

WASHINGTON, June 26.—While the controversy over the merchant shipbuilding program between Maj. Gen. George W. Goethals, general manager of the emergency fleet corporation of the United States shipping board and Chairman William Denman of the board remains unsettled, it is evident that the President does not propose to let it interfere with the expeditious construction of vessels. That was made manifest with the announcement from the White House soon after the conference General Goethals had with the President last Friday that directions had been given by the Chief Executive for the building of all ships possible, both steel and wood, and that authority had been vested in General Goethals to exercise full power granted by congress for the building of a merchant fleet. Plainly this was a victory for General Goethals as against Chairman Denman, and it is confidently believed that the dispute, to be finally ended within a few days, will result in the former gaining the point for which he has contended.

Won't Commandeer Steel Supplies

Among other powers now granted to General Goethals is that to commandeer at once all the ships now building, which can be used by the government, and speed their completion through the expenditure of the appropriation of $450,000,000. This, as already announced, will be done. In this connection it is significant that it has been announced that the power granted by congress to the President to commandeer steel supplies will not be exercised "for the present, nor will the President at this time delegate this authority". It is well known that the President is strongly opposed to the idea of commandeering private industries. The President, it was made known, hopes to reach some basis for steel prices that will make it unnecessary to commandeer.

Evidence indicates that, at the conference held last week between President James A. Farrell of the United States Steel Corporation, as chairman of a committee of the American Iron and Steel Institute; General Goethals, and Chairman Denman, no agreement was reached as to the prices of steel for the shipping program, but that a settlement would be reached without resorting to severe measures. It is understood that Mr. Farrell and General Goethals had no differences, but that Mr. Denman was vigorously opposed to the prices suggested, as well as to the plans to determine the prices, and in consequence has asked the federal trade commission to investigate the situation and fix the prices. Chairman Denman has asked that the trade commission not only fix the prices for steel for the shipping program, but to make them uniform for all steel products both for the government and for private consumers. That approval will be given to such a remarkable and sweeping proposal is unlikely.

Denman Wants Uniform Prices to Private Buyers Fixed Also

General Goethals has urged that the matter of fixing prices for steel for the shipping program be taken up by the steel committee of the council of national defense of which Chairman Elbert H. Gary of the Steel Corporation is head. General Goethals feels that the steel committee referred to should consider the question and report its findings to the general munitions board of the council.

In any event, it is proposed to continue to award contracts for ships, both steel and wood, and to have bids for the former based upon tentative prices for plates, shapes and bars. Whether these prices will ultimately be 4.25c for plates, 4c for shapes and 3.75c for bars, Pittsburgh basis, as provisionally proposed, is a question. It seems probable they will be less. It is not thought, however, they will be reduced to the levels of 2.90c for plates and of 2.50c for shapes and bars, made to the navy and war departments.

The fact that Mr. Denman, as chairman of the shipping board retains powers to operate and to charter ships and as president of the fleet corporation to pass finally on contracts for construction offers him the means to interfere with General Goethals' plans. But, it is thought, if he again attempts to do this either he or General Goethals will be compelled to resign. While there are some reasons to think Chairman Denman could hold the upper hand in this situation, there appears to be overpowering elements entering into the case which lead to the belief that he would be forced to resign, leaving General Goethals unhampered in his work.

Secretary Tumulty said that the President was waiting for further information before settling the difficulties between General Goethals and Mr. Denman. This information, it was stated by Mr. Tumulty, is expected soon. Its character was not made known. Some think it may be connected in some way with the conference reported to have been held in New York last week between Theodore Brent, a member of the board, and Col. E. M. House, socalled confidential adviser of the President. Mr. Brent, like Mr. Denman, is an advocate of wooden ships.

The trade commission has said that the steel investigation as suggested by Mr. Denman will "probably begin immediately". Facts developed, it was stated, would be used as a basis for legislation to be recommended as to prices that should be paid by both the government and individual consumers.

The confusion, politics and other objectionable factors growing out of the question of government purchases has prompted a report that rearrangement may be made of committees of the council of national defense and plans rushed for the creation of a central purchasing commission. Mr. Baruch has been suggested as a candidate to take charge of such a commission, but business interests generally are known to be opposed to his acting in this capacity.

Builders Offer Many Auto Trucks for Army

Washington, June 26.—Bids have been received from 87 manufacturers of automobile trucks for the transport division of the United States army. The government has been in the market tentatively for up to 35,000 trucks, the number required for transport purposes for an army of 2,000,000 men. The number of trucks to be bought will be determined by the immediate and prospective needs for the coming year. Contracts were asked to hold good until the end of the present fiscal year. Bids on 1½-ton and 3-ton trucks were desired principally but many builders submitted figures on other sizes. Time of delivery specified shows many manufacturers are ready to begin turning trucks over to the government at once and others in 30, 60 or 90 days. According to figures compiled by the Society of Automobile Engineers, the makers at the recent bidding pledged more than 100,000 trucks within the year.

Men of the Iron Trade

Personal News of a Business Character Regarding the Men of Affairs of the Industry

FRANK H. CROCKARD, whose ability as upbuilder of steel properties has been stamped upon the rehabilitation of the Tennessee Coal, Iron & Railroad Co., has resigned as vice president and general manager of that company to accept the presidency of the Nova Scotia Coal & Steel Co., New Glasgow, N. S. He succeeds Col. Thomas Cantley, who becomes chairman of the board. The Nova Scotia Coal & Steel Co. is about to embark upon an important program of further development and extensions and as a part of that plan has doubled its common stock. The enlargements of the company's capacity will be under Mr. Crockard's direction. Mr. Crockard has had long experience as an iron and steel operating man. After his graduation from Lehigh University and the Michigan School of Mines, he became foreman of Benwood, W. Va., furnace of the Riverside Iron Works. His father was furnace superintendent. Later he revived the Jefferson Iron Works, Steubenville, O., and then returned to Riverside as blast furnace superintendent. His promotion to assistant manager of the works, then the second largest steel pipe mill in the country, followed. Mr. Crockard's work at Benwood attracted the attention of the Tennessee Coal, Iron & Railroad Co., then in the hands of the Gates interests. In June, 1906, he began his service with this company and this continued when the property was taken over by the Steel Corporation. Mr. Crockard is 43 years of age, and is a native of Wheeling, W. Va. His leaving the Tennessee company has brought forth the expression of sincerest regrets from his associates and superiors with whom his marked ability and personal qualities had won a high esteem. President George Gordon Crawford of the Tennessee company in his announcement, says: "Mr. Crockard has rendered loyal and efficient service and his departure is regretted. In leaving, he takes with him the respect and esteem of his friends in the Tennessee company and their best wishes for success in his new field of work."

H. C. Ryding, formerly assistant to the vice president of the Tennessee Coal, Iron & Railroad Co., will succeed Mr. Crockard as vice president. He has been assistant to the vice president and general superintendent. The office of the assistant to vice president has been discontinued. The change is effective July 1. Mr. Ryding has been with the Tennessee company 10 years. He was born in England and received his education in England and Germany. His experience in the steel trade has applied both to the metallurgical and operating departments. In association with the late Max Suppes, he built the plant of the Johnson Co. at Johnstown, Pa., and at Lorain, O. From the Lorain works he took up his work in the south in 1907.

It is understood that C. J. Barr, former general superintendent, will return to the service of the Tennessee company and will be associated in the carrying out of the extensive enlargements at Fairfield, appropriations for which recently were made.

FRANK H. CROCKARD

Thomas L. Quinn, secretary-treasurer of the Lebanon Steel Foundry, Lebanon, Pa., has been elected a director of the Farmers' Trust Co., Lebanon.

Charles M. Schwab, chairman of the Bethlehem Steel Corp., who recently has been suffering from neuritis, is recovering.

Leonard Miller, a member of Oglebay, Norton & Co., Cleveland, is critically ill at Charity hospital in that city. Mr. Miller recently was brought home from Florida in a dangerous condition.

Shirley S. French, for some time general manager of the William Tod Co., Youngstown, O., has been elected vice president and general manager of the General Fireproofing Co., Youngstown, O.

August Heckscher has offered to the town of Huntington, L. I., a park in that village which he built at an expense of more than $125,000. His gift will be accompanied by an endowment sufficient for maintenance.

G. C. Jones, formerly metallurgical engineer for the Whiting Foundry & Equipment Co., Harvey, Ill., has resigned and taken a position with the Huntington Steel Foundry Co., Huntington, Ind.

Carl W. Bock has been made manager of the Walter A. Zelnicker Supply Co., dealers and manufacturers of railway equipment and supplies. For the past 10 years Mr. Bock has been assistant to the vice president of the Union Pacific Coal Co. and its subsidiaries at Omaha.

E. A. Langenbach, chairman of the United Alloy Steel Corp., Canton, O., and O. A. Transue, president of the Transue & Williams Steel Forging Corp., Alliance, O., have been made president and vice president respectively of the McCaskey Register Co., Alliance, O.

Major Allerton S. Cushman, of the ordnance officers' reserve corps, has been assigned to Frankford arsenal, Philadelphia. Major Cushman is head of the Institute or Industrial Research, Washington, and is noted for exhaustive tests on ingot iron and research work on the corrosion of iron and steel.

C. H. Hobbs, former assistant to A. P. Van Schaick, district sales manager of the Lackawanna Steel Co. at Chicago, has been made district sales manager of his company at Detroit, succeeding Jay C. McLauchlan, resigned. Mr. Hobbs has been associated with the Lackawanna Steel Co. about nine years.

O. M. Stowe, who resigned his position as treasurer of the D. M. Sechler Implement & Carriage Co., Moline, Ill., March 1, has accepted the position as manager of the 3P Auto Tractor Co., Davenport, Iowa. This company was recently organized and will manufacture a tractor attachment for Ford cars.

Standish Meacham of Cincinnati, advertising manager of Rogers, Brown & Co., and son of D. B. Meacham, member of that company, is sailing for France to join the American ambulance field

service. His brother, Robert D. Meacham, now is in active service with this organization in France.

R. H. Parks has been appointed operating manager of the Canadian Car & Foundry Co. and will have charge of all the car plants. He has been identified with the car-building industry for many years and came to Canada from the Bettendorf Co., Bettendorf, Iowa. W. S. Attwood has been appointed assistant to W. W. Butler, vice president and managing director of the company. Messrs. Parks and Attwood have left for Fort William, Ont., to arrange for the equipment of the plant of the company in that city, where a part of the extensive contract for cars recently secured from the Canadian government will be filled.

Oden H. Wharton, assistant to the president, the Crucible Steel Company of America, Pittsburgh, has been elected president of that concern, effective July 1. Since the death of C. C. Ramsey several months ago, Mr. Wharton has been acting as assistant to Herbert DuPuy, chairman of the board and temporary president, previous to which time he had been general manager of sales. Mr. Wharton has been identified with the Crucible company since its organization. He was at one time associated with Park Bros., Pittsburgh, which was absorbed by the Crucible company.

Opens American House

Strachan, Oswell & Co., Ltd., 6 Broad street place, London, E. C., have followed the precedent established by several leading British export houses by forming a subsidiary company, under the style of Strachan, Oswell & Jepson, Inc., with offices at 32 Broadway, New York. The parent company has been an extensive buyer in this country during the past two years. The New York branch is in charge of Vernon B. Jepson. E. T. Strachan, who recently has been on an extended tour in South Africa, is expected to arrive in New York in about a month. Strachan, Oswell & Co., Ltd., have been established in London for nearly 20 years, trading with South Africa, Muritius, the Straits Settlements and China. Strachan, Oswell & Jepson will operate both as a buying agent for firms abroad and selling representative for American manufacturers.

J. Ensign Fuller, Hotel Imperial, New York, recently leased the Weldon, Dodge and Coplay iron ore properties in Jefferson township, New Jersey, which he in turn has assigned to the Dodge-Weldon Iron Co., a New Jersey corporation with office at 15 Exchange place, Jersey City.

Scales Unchanged

In Tin and Sheet Mills Next Year Under Conference Agreement

No changes will be made in wage scales now prevailing in sheet and tin plate mills working under an agreement with the Amalgamated Association of Iron, Steel and Tin Workers. Manufacturers and officers of the Amalgamated association at a conference at Atlantic City, June 25, voted to continue wage rates now in effect for the year ending July 1, 1918.

Wages in both divisions are based upon graduated scales. The sheet mill scale is based upon a 2.15c card; for each advance of 5 cents in the actual invoiced selling price of Nos. 26, 27 and 28 gage plain sheets, wages automatically are advanced 1½ per cent. For each decrease of 5 cents, wages are reduced 1½ per cent until the 1.80c card is reached. The tin mill scale is based upon a 3.50c card. For each increase of 5 cents in the actual average invoiced selling price, an increase of 1 per cent in wages is provided; and for each decrease of 5 cents, wages are reduced 1 per cent until the 3.20c card is reached. Sales averages are established at a bimonthly examination of sales sheets.

Wage rates in bar iron mills are being considered this week. The wage committee of the Amalgamated association recommended an increase of 50 cents a ton for boiling up to and including the 1.25c card, an increase of 15 cents on the 1.30c card, 10 cents on the 1.35c card, and 5 cents on the 1.40c card. No changes have been suggested when the actual sales average price of bar iron is above 1.40c. Proposed increases are based upon $6 a ton for boiling on a 1c card. Prevailing rates are based upon $5.50 a ton for boiling on a 1c card.

Occupies New Plant

The American Valve & Tank Co., has removed from Indianapolis to its new plant at Fairmont, W. Va. A 60 x 160-foot iron and brass foundry and a 90 x 180-foot machine shop with provision for a later extension 90 x 200 feet are included in the new plant. All building are of the monitor type, are equipped throughout with electricity and are constructed for future expansion. Numerous conveniences have been installed for the benefit of employes.

Takes Output of Mill

The Commercial Iron & Steel Corp., 115 Broadway, New York, has contracted to take the entire output of the Sligo Iron & Steel Co., Connellsville, Pa., for a period of two years. The Sligo company has the following mills: An 8-inch guide, a 16-inch bar and a 20-inch muck and a steel or iron 60-inch plate mill. The bar mills now are operating double turn and the plate mill is expected to go in about Aug. 1. The Commercial corporation has made arrangements whereby the sale of the Sligo company's products and the Commercial corporation's interests generally in the Pittsburgh district will be handled by the Ward-Darley-Lupold Co., First National Bank building, Pittsburgh. The Ward-Darley-Lupold Co. also will act as the Pittsburgh representative of the Federal Export Corp. of which the Commercial corporation is a subsidiary.

Award Mill Town Houses

A contract has been awarded by the Carnegie Steel Co. to Stone & Webster for the erection of 200 houses on the site of the Steel Corporation's proposed model town at McDonald. The contract will involve the expenditure of over $500,000. Work is to start at once. Some of the new McDonald bar mill units will be in operation within a few months. Stone & Webster also have the contract for grading the more than 600-acre town site on which the houses are to be erected.

Starts New Can Plant

Chicago, June 26.—The Continental Can Co. has bought 20 acres at Sixty-fifth street and South Fifty-fourth avenue, 900 x 980 feet and will start immediately the first unit of a 4-story standard mill and reinforced concrete plant. The building will be in the shape of the letter "E", with sixteen shipping and receiving platforms 300 feet long and 27 switching tracks for eight cars each. A feature will be a 4-story wing 120 feet square for the convenience of employes, containing dining and rest rooms, lockers, wash and toilet rooms. The company now operates two other plants in Chicago as well as at Syracuse, N. Y., and Baltimore, and a tin plate mill at Canonsbury, Pa. The new plant and site will represent an investment of over $3,000,000. Plans are being made by Davidson & Weiss, Chicago.

Buy Engineering Plant

The Pennsylvania Engineering Co., New Castle, Pa., and the Miller-Smythe Co., Youngstown, O., have purchased the machinery and buildings of the Youngstown Engineering Co., Youngstown, O. Plans have been made by the latter company, the holdings of which include a 3½-acre site, to remove its plant to the former Youngstown Engineering property, where it will continue to handle electrical equipment.

Iron and Steel Financial News

Up-to-the-Minute Fact and Comment Collected and Sifted For Busy Readers

War Dominates Whole Field of Business

"ALREADY the maxim 'Business as Usual' has become an absurdity. Certain industries have been swollen far beyond their customary activity through the manufacture of munitions and materials for our allies. All the workers in such plants have received and have spent more money. The country has received this stimulus and has reaped the profits for nearly three years. Now we must look on the other side of the picture as well. Business will continue at a high pressure, but it will be business directed toward one end. That end is war. Plants which do not or cannot adapt themselves to the manufacture of things which are needed are bound to suffer. Their workmen will have plenty of opportunity for employment, for the experience of our allies has shown that it is a shortage of labor, and not a surplus of labor, that has constantly to be met."

This view, recently expressed by Thomas W. Lamont, of J. P. Morgan & Co., is becoming the firm conviction of many leading business men. As time goes on and the country's preparations for war progress, there is a growing realization of the tremendous amounts of materials that will be required, of the machinery that will be needed to transform this material into essential products, and of the labor that must operate this machinery. A practical example of how the war is affecting many industrial companies is seen in the case of a big machine tool builder. When this country entered the war the machinery company divided the business on its books into three classs. The first class included orders for the allied governments, United States government orders and work for private manufacturers engaged in government work. The second class included principally tools for railroads, because maintenance of transportation is essential. The third group included orders from private manufacturers whose products are not needed in the conduct of the war. But the pressure of government business has been so great that this builder has eliminated the third group and a large part of the second class, now concentrating practically all of its energies upon orders of the first class.

The big makers of ordnance, the various large machinery builders, and other metal working industries engaged in war business are finding the skilled labor situation even more strained. Many companies are building dwellings by the hundreds, to house their present armies of employes. The only labor supplies which can be drawn upon are those engaged in non-essential work.

Estimates as to the tonnage of American steel to be needed in the prosecution of the war, both in our own preparations and for the allies now range from 20 to 50 per cent, although only a short time ago no lesser authority than Judge Elbert H. Gary expressed belief that the United States' war needs over the next 12 months would not exceed 5 per cent of the annual production of steel. The allies' steel requirements in 1916 are estimated to have been from 15 to 20 per cent of the annual production of the United States.

With the tonnage to be diverted for government purposes, so indefinite, and with the prices to be paid continuing uncertain, even the Wall Street statisticians are making little effort to estimate the future earnings of the various leading steel producers. The problem of war taxation now being studied in the senate finance committee is another unknown factor with a bearing upon steel earnings. In short, the readjustment from a war to a peace basis is as yet so incomplete that the stock market analysis have few promises from which to reason. Current steel company earnings cut little figure in establishing the present steel stock quotations. The breeze before which the stock market backs and fills is the sentiment at the moment as to what will be the ultimate outcome at Washington in the settlement of raw material prices to the government.

Furnace is Acquired

The Northern Ore Co., Real Estate Trust building, Philadelphia, recently organized with T. I. Crane as president, has purchased the Keystone furnace at Island Park, Easton, Pa., from the Thomas Iron Co. This furnace, which has been idle since 1911, is to be put in operation as soon as necessary repairs have been completed.

Increases Capital to Take Over Southern Mills

Ft. Worth, Tex., June 26.—The Texas Rolling Mill Co. has amended its charter, changing its name to George W. Armstrong & Co., and increasing its capital stock from $240,000 to $650,000. This action is to enable the carrying out of plans for the consolidation of the company's rolling mill with a similar plant at Sand Springs, Okla., owned by the Oasage Iron & Steel Co., which has also gone out of existence as a corporation. George W. Armstrong & Co., have taken over both plants. New machinery and equipment will be installed in the two plants and their capacity for the manufacture of bar iron and reinforcing bars will be enlarged.

Dayton Property Sold and Will Be Rebuilt

Possession of the Dayton Coal & Iron Co., Dayton, Tenn., which has been the subject of litigation for many years, has been obtained by Harry S. Matthews, Rome, Ga., for a consideration of $400,000. A consolidation of Matthews interests in Georgia and Tennessee and the formation of a new company is anticipated. The property, consisting of two blast furnaces, mines and timber, will be improved. About $100,000 will be spent in reconstructing the plant at Dayton. By using coal produced at Dayton and ore from the holdings in Georgia, it is planned to make the Dayton property more remunerative. Mr. Matthews, formerly was president of the Alabama Consolidated Coal & Iron Co., now the Alabama Co., of Birmingham, Ala. He now is president of the Matthews Iron & Steel Co., Rome, Ga., an enlargement of the Matthews Iron & Mining Co., which recently acquired the Rome blast furnace and iron ore properties nearby. The Iron & Steel company, capitalized at

$1,000,000, recently figured in a transaction wherein a large block of common stock was purchased for cash by a New York banking syndicate.

Detroit Iron and Steel Cuts Large Melon

The Detroit Iron & Steel Co., Detroit, an affiliation of M. A. Hanna & Co., Cleveland, and owner of two blast furnaces at Detroit, has declared a 100 per cent stock dividend, a 10 per cent cash dividend on common and a 1¾ per cent cash dividend on preferred. Capital stock of the company was recently increased from $1,500,000 to $2,500,000. Stockholders approved the recommendation of the directors that the common be increased from $750,000 to $1,500,000 by the transfer of $750,000 from accumulated earnings and that the new stock be given holders in the form of a 100 per cent stock dividend, payable July 2. The cash dividend of 10 per cent will be disbursed in quarterly installments of 2½ per cent, the first to be made July 16 on stock of record July 2. The preferred dividend also will be paid July 16, on stock of record July 2.

Coal Tar Product Makers Form Combination

The National Aniline & Chemical Co., organized for the purpose of manufacturing dyes from coal tar products, will open offices at 244 Madison avenue, New York, July 1. Preparations have been made to compete vigorously with Germany, for the world's supremacy in the dye industry. Following are the companies entering into the consolidation: The Schoellkopf Aniline & Chemical Works, Inc.; The W. Beckers Aniline & Chemical Works, Inc.; the National Aniline & Chemical Co., and the Benzol Products Co. Certain properties of the General Chemical Co., the Barrett Co. and the Semet-Solvay Co. also enter into the combination. Officers of the organization are: William H. Nichols, chairman of the board; J. F. Schoellkopf, third vice president, and first vice president; I. F. Stone, second vice president and treasurer; Hugo Schoellkopf, third vice president, and William T. Miller, secretary.

Nova Scotia Steel Will Double Common Stock

Toronto, June 25.—The directors of the Nova Scotia Steel & Coal Co. have voted to increase the common stock from $7,500,000 to $15,000,000. An issue of $5,000,000 will be offered at par to shareholders of record June 30 and in November a stock bonus of 20 per cent will be distributed to shareholders. The money to be raised by the new issue is required as additional working capital. It is understood that the ore-hoisting dock facilities at Wabana, Newfoundland, are to be largely increased with a view to the expansion of the export trade in iron ore to the United States.

Trumbull Steel Increases Capital to Enlarge

A recommendation made by the board of directors of the Trumbull Steel Co., Warren, O., provides for an issue of preferred stock sufficient to increase the capital of the company from $10,000,000 to $12,000,000. The additional working capital will be used to enlarge the open-hearth and plate departments; to acquire coal lands now under option, and to purchase raw materials, although the company now has a stock of raw materials valued at $5,000,000. About 300,000 tons are finished annually at the company's plant.

Financial Crop Ends

The capital stock of the Liberty Steel Co., Warren, O., is to be increased from $600,000 to $750,000 and $150,000 of 10 year 6 per cent bonds will be issued. Eight instead of six sheet mills will be built. The first mill will be in operation about February 1.

* * *

The General Refractories Co., Chester, Pa., has purchased properties of the Eagle Brick Co., near Lock Haven, Pa. The General company is controlled by William C. Sproul.

* * *

On a basis of one new for each present three, the Semet-Solvay Co., Syracuse, N. Y., offers for subscription $4,000,000 of capital stock authorized Feb. 27 to stockholders of record June 20.

* * *

Directors of the Empire Steel & Iron Co., Catasauqua, Pa., have declared a preferred accumulated dividend and a semiannual dividend of 3 per cent each on stock of June 20 record. Disbursements will be made July 2.

* * *

Three new vice presidential offices were created at a recent meeting of the board of directors of the Westinghouse Electric & Mfg. Co., and the following men were chosen to fill them: Henry D. Shute and Herbert T. Herr, of Pittsburgh, and Walter Cary of New York. Other officers reelected are: Guy E. Tripp, chairman of the board; E. M. Herr, president; L. A. Osborne, Charles A. Terry and H. P. Davis, vice presidents; T. P. Gaylord, acting vice president; James C. Bennett, comptroller and secretary; W. H. Jones, assistant secretary; S. H. Anderson, assistant treasurer and assistant secretary; F. E. Craig, auditor, and W. B. Covil, assistant auditor. H. F. Baetz, assistant treasurer, was elected to succeed Mr. Shute as treasurer. L. W. Lyons was elected assistant treasurer to succeed Mr. Baetz. W. J. Patterson was chosen for the newly created position of assistant auditor.

Delayed Buying

Of Coal Tar Products by Various Governments Holds Up Market

New York, June 26.—Delays in the placing of contracts for toluol, benzol and phenol for the United States and foreign governments continue responsible for the more or less indefinite situation which characterizes the coal tar products market. Huge quantities of benzol and phenol are wanted for export and large quantities of toluol will be required for new trinitrotoluol contracts now being negotiated for this country. The foreign business is being held up by the delay in arranging credits for the allies from the funds loaned by this government. In the meantime, considerable foreign business principally benzol has been placed through temporary agents.

Increasing scarcity of vessels and the consequent inability to ship material due on old foreign contracts is a growing factor. Shipments of a large amount of material are being held up. Pure benzol continues to be quoted at 53 to 60 cents per gallon, both for spot and contract and toluol at $1.75 to $2 per gallon, for spot and $1.50 to $1.75 for contract. The market in phenol is slightly easier at 38 to 40 cents per pound both for spot and contract. Numerous contracts for solvent naphtha for the next 6 to 12 months have been closed during the week. Prices are unchanged at 18 to 22 cents on contracts.

Active contract buying of sulphate of ammonia for delivery over the next 6 to 12 months has resulted in a well sold up condition in this market. Consumers who still have unfilled requirements over the next four or five months are having difficulty in placing them. The market continues firm at $4.85 to $5 for spot and at $4.40 to $4.50 on contracts per 100 pounds, at seaboard.

Coke Oven By-Products

Spot.

Per Gallon at Producers Plant.

Pure benzol	$0.55 to .60
Toluol	1.75 to 2.00
Solvent naphtha	.18 to .25

Per Pound at Producers Plant.

Phenol	$0.38 to .40

Per 100 Pounds at Seaboard.

Sulphate of ammonia	$4.85 to 5.00

Contract.

Per Gallon at Producers Plant.

Pure benzol	$0.55 to .60
Toluol	1.50 to 1.75
Solvent naphtha	.18 to .22

Per Pound at Producers Plant.

Phenol (nominal)	$0.38 to .40

Per 100 Pounds at Seaboard.

Sulphate of ammonia	$4.40 to 4.50

Air Fleet Builders May Be Buyers

Willys-Curtiss Combine Foreshadows Heavy Purchasing is Belief of Well-Informed Tool Manufacturers—Cranes Sold Far Ahead—Shell Contracts Revive Machinery Markets—Price Changes Are Made in Chicago

MACHINERY builders are feeling the direct influence of the government's war requirements as no other branch of industry has as yet been affected. The demand for rifle drilling machinery and other special equipment for turning out field guns, howitzers and other ordnance is tremendous. The same conditions apply to heavy machinery for structural and boiler shops, shipyards, etc. The supply of big lathes and shapers, 8-foot boring mills, 24-inch slotters, punching and shearing machinery is almost wiped out for many months ahead. Several builders are rushing new plant construction, but the supply of labor is considered hardly sufficient for facilities now existing. One leading builder says that if the capacity for producing certain types of machines could be doubled tomorrow, the increase would be of unlimited benefit to the country.

Several of the shipbuilding projects which had been pending are assuming more definite form since the signing of the war budget bill by President Wilson over a week ago. The Merrill-Stevens Co., Jacksonville, Fla., has closed for shipbuilding equipment in connection with extensions to its yard. The Newport News Ship Building & Dry Dock Co., Newport News, Va., which has been steadily buying cranes and machinery for several months, is again in the market for both cranes and heavy tools. The Baltimore Dry Dock & Ship Building Co., Baltimore, has not yet closed for the list of 21 cranes for which it recently inquired. The Chester Ship Building Co., Chester, Pa., has closed for six locomotive cranes for two additional ways at its Chester yard. The Chester company is understood to be planning a huge new plant at Bristol, Pa.; its tentative negotiations for this work involve 40 or more locomotive and special cranes.

Several Tool Lists Appear

Builders of small machines are watching developments in the aeroplane industry with much interest. The recent connection of the Willys-Overland interests of Toledo, with the Curtiss Aeroplane & Motor Co., has given rise to reports that the entire Willys plant at Toledo is to be given over to aeroplane work and that the Morrow Mfg. Co., Elmira, N. Y., which had been building transmissions for the Willys-Overland cars, is to make aeroplane parts. The Curtiss-Willys Co., Buffalo, is inquiring for a list of tools, including a 72-inch open-side planer; one 5-foot and one 6-foot boring mill; one 60-inch lathe, hoisting machines, air tanks and other equipment for an aeroplane plant.

The General Electric Co., Schenectady, N. Y., which has been issuing inquiries almost daily for months, issued a list of 22 tools last week, including four boring mills, one milling machine, a shaper and miscellaneous machines. The Traylor Engineering & Mfg. Co., Allentown, Pa., has issued a small list of machine shop tools, including one 24-inch slotter, one 8-foot boring mill, one 48 x 48-inch x 10-foot planer, one pipe-threading machine and one 2 x 24-inch screw-cutting machine. The Skinner & Eddy Corp., Seattle, Wash., steel shipbuilder, has issued a list of tools to eastern sellers, and these machines will be purchased immediately. The list appears in detail on page 1424.

Buying from brass mills and munition makers continues, although few lists are appearing, in most cases inquiries being for tools for filling out or replacement purposes. The New York Air Brake Co. has been a buyer of tools the past week in connection with its government contracts for cartridge cases and gun mounts. The E. W. Bliss Co., Brooklyn, N. Y., also has been buying considerable equipment in connection with government contracts, but this company specializes in certain types of tools and its inquiries do not appear in the open market. Sellers report a good volume of business, although demand for light tools is by no means proportionate to demand for heavy machines. Many dealers have small lathes on their hands, of which they are unable to dispose, while builders' stocks of such tools are in some cases accumulating.

Chicago & Northwestern Will Close List Soon

ADVANCES of 5 to 15 per cent on almost all kinds of machine tools are being received by dealers in the Chicago district. Radial drills have been advanced about 15 per cent and boring mills 10 per cent. Some manufacturers whose outputs are sold for the remainder of the year have withdrawn all quotations, but will take orders for remote delivery at prices prevailing at the time of shipment. Builders of engines, pumps and deck hoists are interested in proposals from the government for 375 of each of these devices with a privilege of increasing the order 25 per cent. They are for use on new ships to be constructed under government supervision. Business continues excellent with practically all lines of manufacture represented. While most orders are for single tools, an occasional order is taken which runs into a large sum. The Chicago & Northwestern railroad has taken figures on its list published last week and it is understood the business will be placed shortly.

The Beckemyer Foundry Co., Beckemyer, Ill., a recently incorporated company, will proceed at once to build a foundry. The Krasberg Mfg. Co., Chicago, and the Lanham Mfg. Co., Chicago, will build plants. The Monighan Foundry Co., Chicago, is building an addition to its foundry. The Electric Wheel Works, Quincy, Ill., will build a factory. The Hercules Steel Castings Co., Milwaukee, has plans for a new plant. The Hill Standard Mfg. Co., Anderson, Ind., will add a factory for the production of wheels for agricultural implements. The Chicago Stove & Range Co. is building a machine shop and warehouse at Benton Harbor, Mich. The Union Iron Works is building a machine shop at San Francisco to manufacture turbine engines. The Monarch Foundry Co., Stockton, Cal., and the Hendricks Mfg. Co., Seattle, are both building machine shops.

Waterworks extensions and power house building continue active through the west. Abeline, Tex., is planning a waterworks plant to cost $500,000. Lake City, Iowa, will add two pumps, and Knoxville, Iowa, will build a municipal plant. Shawano, Wis., is about to install a corliss engine. Talladega, Ala., is building

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Yesterday you rode over these same roads and were bumped almost to pieces—but ***today,*** because the car in which you are riding is equipped with springs made of AGATHON STEEL, the roughness is unnoticeable.

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Special Analyses
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon

All guess work is eliminated in the making of AGATHON STEELS. The quality is controlled by ***facts.*** The analysis is constantly sampled. Test bars are frequently poured during the preparation of every heat. These test bars are broken and the fracture carefully examined. When the eye has been satisfied, the bar is rushed to the laboratory where samples are drilled and subjected to minute chemical analysis.

By attaching the greatest importance to even the small details, we are able to give you a superior steel for ***Springs, Connecting Rods, Crank Shafts, Driving Shafts, Pistons, Cams, Gears,*** etc.

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Cleveland Office: Hickox Bldg., The Hamill-Hickox Co., District Representative
Chicago Office: Room 1370 Peoples Gas Bldg., 122 South Michigan Blvd., A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Bldg., Frank Wallace, District Representative
J. E. Dockendorff & Co., 20 Broad St., New York, N. Y., General Export Agents

a waterworks system of 1,000,000-gallon capacity. The Chicago & Northwestern railroad will provide a large power plant in connection with its new round house at Chase yards, Milwaukee.

Shell Orders Revive Pittsburgh Market

DISTRIBUTION of large orders for shells by the United States government has revived demand for munition-making equipment. Tentative inquiries have come out on a large number of lathes and presses. The government also is negotiating for machine shop equipment for battleships and tenders. Pittsburgh interests who have purchased the machinery of the Chattanooga Steel Co., Chattanooga, Tenn., will transfer the equipment to a new plant in western Pennsylvania at an early date. Additional machinery will be required to complete the undertaking. On account of deferred deliveries, many concerns are scouring the market for second-hand cranes, punches and shears.

Business Continues Brisk in Cleveland

SOME local machine tool dealers have closed on a wide line of heavy machines for use in Cleveland and nearby cities and in spite of the usual summer lassitude in the machine tool market, inquiries continue to come in. The Cleveland Milling Machine Co., Cleveland, has bought a number of machines, and it is understood is still in the market for some miscellaneous equipment. The Upson Nut Co., Cleveland, has also purchased a few new tools. The McMyler Interstate Co., Bedford, O., has purchased a number of heavy tools and it is stated by some Cleveland dealers that the list has not been entirely closed. Speculation was rife among local machinery houses early in the week as to the source of a list which is said to have been placed in the hands of certain local interests. The inquiry calls for a heavy expenditure and the tools are said to be all heavy-duty, large type. The rubber companies of Akron, recently buyers in the Cleveland market are not active, having closed for the most part on the equipment sought. No price changes have been noted and deliveries on some lines have improved.

Cincinnati Business Light

THE present price of plates is curtailing, to some extent, the operations of boiler and tank manufacturers. They are devoting most of their attention to repair jobs. A better demand is noted for machine tools from domestic sources, as many firms have put in bids on government work, and are endeavoring to locate all extra machines needed in case they are awarded contracts. Some delays in shipping machine tools have been reported, but where the machines are even remotely connected with government work, there is little trouble in getting tools to their destination. Auto-truck builders have lately purchased a comparatively large number of machine tools, placing the orders, in most instances, in small lots of one to five machines. Pleasure car manufacturers have practically ceased buying machinery of any kind, except for urgent replacement purposes. The foreign inquiry is very light, and few new orders have been booked lately.

New Construction and Equipment

Concise and Timely Business Building Opportunities from the Field of Industry

Along the Middle Atlantic Seaboard

AMSTERDAM, N. Y. — McCleary, Wallin & Crouse have plans for a 3-story factory building. F. Sheldon & Sons are the architects.

BUFFALO.—Larkin & Sangster, Inc., have been incorporated with $100,000 capital to engage in contracting and construction by E. P. Burnside, H. E. Larkin and A. A. Sangster.

BUFFALO.—J. W. Hennessy, Inc., capital $100,000, has been chartered to engage in the construction and contracting business by W. H. Dwyer, J. W. Hennessy and I. L. Fisk.

BUFFALO.—The Donner Steel Co. is making extensions and improvements involving $65,000.

CORTLAND, N. Y. — Gooley & Edlund have let a contract to Dawson Bros., Syracuse, N. Y., for a 1-story, 60 x 160-foot factory building to cost about $25,000.

JAMESTOWN, N. Y. — The Black Belt Corp., chartered with $10,000 capital will manufacture belting and mill supplies. P. A. Simpson, E. N. and F. E. Gould are the incorporators.

NEW YORK.—The Indian Copper Co. has been organized in Delaware with $100,000 capital to mine, reduce and smelt ores. The incorporators are: Arthur W. Britton, Henry O. Coughlan and George V. Reilly.

NEW YORK.—The L. B. Stilwell Engineering Corp. has been chartered with $100,000 capital to act as construction engineer by L. B. Stilwell, H. S. Putnam, 118 East Fifty-fourth street, et al.

NEW YORK.—The Necomb Iron & Steel Co. has been organized with $10,000 capital to make boilers and railroad equipment by A. C. Smith, P. V. Hoyler and I. H. Schafer, 27 Pine street.

NEW YORK.—A contract has been let to H. Besking, 735 Greene avenue, Brooklyn, for a building to cost $100,000, for the Metropolitan News.

PHELPS, N. Y. — The Dealers Cement Corp., recently incorporated, has let the general contract for a $1,250,000 cement plant.

NEW YORK.—The Columbia Extinguisher Corp. has been organized with $150,000 capital to manufacture fire extinguishers by A. Coppel, T. A. Havemeyer and E. H. Downing, 174 Centre street.

NEW YORK. — The Metropolitan Weather Strip Co., newly organized with $10,000 capital will make weather strips and hardware specialties. The incorporators are: G. A. Robbins, E. F. Bosley and H. H. Mullins, 117 Chambers street.

NEW YORK. — The Terry Shipbuilding Corp. has been chartered with $100,000 capital to build ships by F. Tench, H. F. John and G. O. Wagner, Grand Central Terminal.

NEW YORK. — The Lippincott Chemical Co. has been incorporated with $25,000 capital to make chemicals by W. A. Lippincott, B. Berkow and J. F. Russell Jr., 43 Cedar street.

NEW YORK.—The Witherbee Storage Battery Co. has been incorporated with $10,000 capital to make motors, etc., by C. Staudt, C. and P. Meder, 990 First avenue.

NEW YORK. — The Chelsea Truck & Wagon Works has leased, for a period of 10 years, the buildings at 440-42 West Twenty-seventh street.

SYRACUSE, N. Y.—The I. G. Jones Co., organized with a capital of $50,000, will manufacture engines, boilers, etc. I. G. Jones, H. L. Betts and F. C. Faulkner are the incorporators.

TRENTON FALLS, N. Y.—The Utica Gas & Electric Co. has awarded the general contract for an addition to its hydroelectric power

ONE
30-Ton Open Hearth
FURNACE
Now Ready.

Who wants the Entire Production of it for Ingots or Shell Blanks?

Hubbard Steel Foundry Co.
EAST CHICAGO, IND.

All Kinds of Iron and Steel Rolls and Steel Castings.

Say you saw it in THE IRON TRADE REVIEW

plant here to the Structural Concrete Co., Dayton, O.

DOYLESTOWN, PA. — The Doylestown Agricultural Works has completed plans for an addition and will start construction work soon.

FLEETWOOD, PA. — The plant of the Fleetwood Metal Body Works was damaged by fire a short time ago, and a loss of $75,000 entailed.

LANCASTER, PA.—The O. K. Clutch & Machine Co. plans to begin the erection of a plant on a plot which it recently purchased at Florence street and Mill road.

PALMERTON, PA.—The New Jersey Zinc Co. will build a 3-story laboratory to cost $200,000.

PHILADELPHIA. — Stearns, Woodnut & Schmohl, engineers, South Twenty-third street, will build a 2-story plant, 48 x 126 feet, to cost $18,000. The name of the owner is withheld.

PHILADELPHIA. — The Crew-Levick Co. soon will take bids for an oil plant at Pettys Point. The plant will consist of a 2-story building 72 x 618 feet, a 1-story building 70 x 120 feet, a power house 30 x 48 feet and a dock 40 x 1200 feet.

PHILADELPHIA.—Joseph T. Pearson has conveyed to the Joseph T. Pearson's Sons Co. a 3-story manufacturing building and other structures at 1810-1834 Adams street.

PHILADELPHIA.—John Uber has been granted a permit to erect a machine shop addition at 1938 South Twentieth street.

PHILADELPHIA.—Berko Bros. have purchased property on Old York road. The buildings now on the site will be demolished and a large manufacturing building erected.

PHILADELPHIA.—The Trussed Concrete Steel Co., Youngstown, O., has purchased a site and will erect a plant.

PHILADELPHIA.—J. & J. Dobson, Inc., has been granted a permit to erect an addition to its manufacturing building at Rich avenue and Crawford street.

PHILADELPHIA.—The Stokes & Smith Co., Bomerdale avenue, will start work soon on a forge shop to be 1-story, 27 x 34 feet and cost $4,000.

PITTSBURGH.—The plant of the Pittsburgh-Electro Galvanizing Co. recently was damaged by fire.

WARREN, PA.—The Warren Oil Co. has purchased a 12-acre site and plans to build a $50,000 plant.

BLOOMFIELD, N. J.—The Jenkins Mfg. Co., 35 Farrand street, plans plant additions.

ELIZABETH, N. J.—The American Foundry Co. has been incorporated with a capitalization of $125,000 to engage in a general foundry business: Morris Jigger, Otto Froebel, et al, are the incorporators.

Shipbuilding Tools

Will be purchased by the Skinner & Eddy Corp., Seattle, Wash. The following machines are required:

One 72-inch engine lathe, 32-foot bed, motor-driven.

One 36-inch engine lathe, 34-foot bed, motor-driven.

Two 36-inch engine lathes, 26-foot bed, motor-driven.

One 22-inch single traveling head shaper, length 7 feet.

One 72-inch open-side planer, length 16 feet, motor-driven.

One horizontal boring, drilling and milling machine.

One 24-inch crank slotter, motor-driven.

One boring and turning mill.

One 6-foot heavy-duty radial drill with reversing gears, motor-driven.

One 4-foot plain radial drill, motor-driven.

One keyseater, stroke 25 inches, motor-driven.

One heavy-duty universal milling machine, range 34 inches.

One 3¼ x 36-inch flat turret lathe for bar work.

One 27-inch heavy-duty engine lathe, 18-foot bed.

Two 14-inch engine lathes, 8-foot bed with taper attachment.

FLEMINGTON, N. J.—The Dural Rubber Corp., recently incorporated, will build a factory to make rubber equipment, automobile tires, etc. Edgar H. Wilson, 249 Spring street, Trenton, N. J., is president.

GLOUCESTER, N. J. — The New Jersey Shipbuilding Co. has let a contract to George F. Pawling & Co. for the erection of four buildings for a new ship yard. It is expected the cost of this improvement will be about $1,000,000.

JERSEY CITY, N. J.—The Detroit Steel Products Co. recently has been incorporated with $1,250,000 as manufacturers of steel, iron and other products by John G. Rumney and Harold F. Wardell.

MANASQUAN, N. J.—The Imperial Porcelain Co. has started work on a $75,000 plant. F. A. Duggan has the contract.

NEWARK, N. J.—The Mill Creek Mining & Milling Co., newly organized to mine minerals with a capital of $50,000, was incorporated by Theodore Saunders Jr., Augustus J. Mitchell and Joseph L. Feibleman.

NEWARK, N. J. — O. W. Young, Inc., capitalized at $25,000, will manufacture illuminating and lubricating oils. Joseph T. Davey, Patrick A. Blewith, Clarence H. Smith, et al are the incorporators.

NEWARK, N. J.—The Mutual Life Insurance Co. has taken out a permit for a 4-story office building to cost $70,000, and alterations to the main building to cost $20,000.

NEWARK, N. J.—The Liberty Tool Co. has been chartered with $25,000 capital to make tools, machines, etc., by Albert Sarossy, Stephen Schaffer and M. J. Reilly.

NEWARK, N. J.—C. A. Goldsmith has been granted a permit to erect an addition to his foundry at 142 Cutler street.

PLAINFIELD, N. J.—C. H. Hall, Inc., capital $25,000, has been incorporated to manufacture chemicals. The incorporators are: Charles H. Hall, Louis P. Wilson, et al.

TRENTON, N. J.—The Pierce Arrow Tire & Rubber Mfg. Co. plans plant alterations to cost $150,000. H. H. Allen, 406 East Rittenhause street, Philadelphia, has charge.

TRENTON, N. J.—The Malcolmson Briquet Engineering Co. has plans in preparation for a 1-story, $50,000 coal briquet plant.

DOVER, DEL.—The Helen Mineral Co., chartered with $1,000,000 capital, will develop mineral lands. The incorporators are: Herbert Latter, Clement M. Egner and Henry M. Robinson.

BALTIMORE.—The Baltimore Tube Co. contemplates a plant 140 x 600 feet. C. S. Morse is president.

RICHMOND, VA.—The city has let the general contract for an electric light plant addition, 1-story, to cost $10,000, to P. G. White & Sons, Merchants Bank building.

Activities in the Central States

CHIPPEWA FALLS, WIS.—Work now is progressing rapidly on the 1-story, 100 x 250-foot factory building of the Boone Tire & Rubber Co.

CUBA CITY, WIS.—The village board is taking bids for the construction of a deep well and installation of a new pump and motor.

KENOSHA, WIS. — The Winther Motor Truck Co., organized some time ago with $350,000 capital, and now occupying leased factory quarters, is having plans prepared for a 1-story manufacturing plant, 100 x 450 feet, to cost $125,000 with equipment.

MADISON, WIS.—The Cosmodami Amusement Co., E. Bracken, manager, is having plans prepared for a 100 x 130-foot theater building to cost $150,000.

MILWAUKEE. — The International Harvester Co. has been granted permits to build a 1-story warehouse, 50 x 126 feet, and a 1-story office addition, 50 x 100 feet, at Fourteenth and Park streets, Milwaukee.

RACINE, WIS.—Low bidders for the construction of the Racine public auditorium, 112 x 245 feet, 2-story, are: General contract, Northern Construction Co., Milwaukee; steel and iron, Northwestern Bridge & Iron Co., Milwaukee.

RACINE, WIS.—Articles of incorporation have been filed by the Racine Hack Saw Co., capital $10,000, to manufacture and market a line of power hack saws. The incorporators are J. M. Jones, W. D. Thompson and Peter J. Meyers.

RACINE, WIS. — The Racine Auto Tire Co. has completed arrangements for a 5-story, reinforced concrete factory, 260 x 320 feet, to cost $350,000.

WAUPACA, WIS.—The Waupaca Electric Service & Railway Co. will install a new 225 horsepower generating unit and change the system to 60-cycle.

WEST ALLIS, WIS. — The Independent Foundry Co., recently organized with Julius Rauiszewski, president, is having plans prepared for an 80 x 150-foot gray iron foundry.

BENTON HARBOR, MICH.—The Chicago Stove & Range Co., care J. E. Fitzgerald, 2033 South Clark street, Chicago, will build a 2-story machine shop and warehouse, 50 x 150 feet, to cost $40,000. F. D. Chase, 122 South Michigan avenue, Chicago, is the architect.

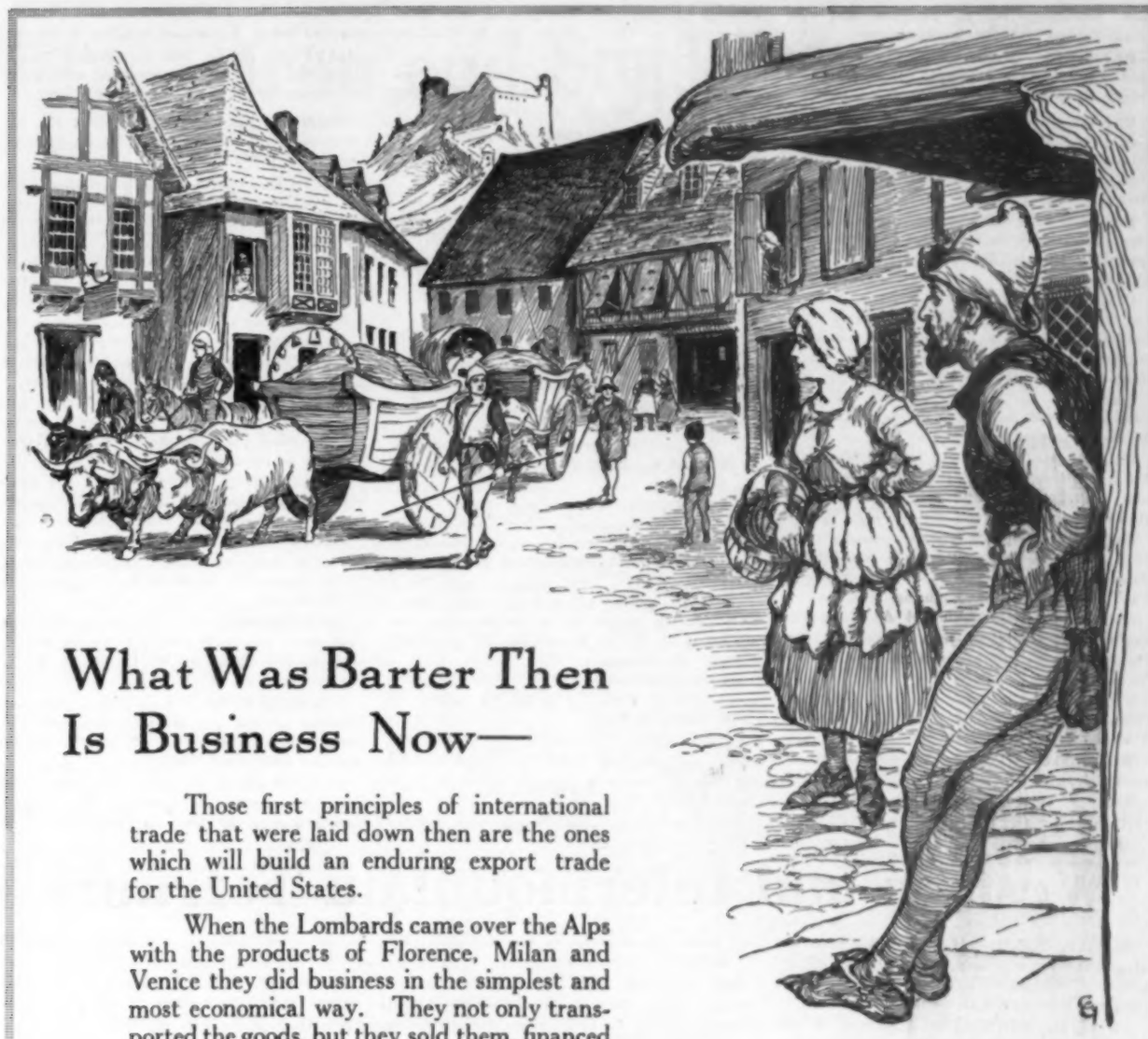
DETROIT. — Plans have been completed for a power house for the Burroughs Adding Machine Co.

DETROIT.—The Woodworth-Cook Tool Co. has been newly organized with $15,000 capital. The incorporators are: Chester R. Woodworth, John T. Cook, et al.

GREENVILLE, MICH. — The Sutherland Tool Co., Flint, Mich., will remove its factory and increase its capacity. Negotiations have been completed.

MARSHALL, MICH.—The Marshall Castings Co., M. Campbell, manager, has let the general contract for a foundry to cost $25,000 to Dodge & Estel, South Haven.

PETERSBURG, MICH. — The Petersburg Electric Light & Power Co. has been chartered to supply electric light and power. Wil-



What Was Barter Then Is Business Now—

Those first principles of international trade that were laid down then are the ones which will build an enduring export trade for the United States.

When the Lombards came over the Alps with the products of Florence, Milan and Venice they did business in the simplest and most economical way. They not only transported the goods, but they sold them, financed them and handled every other detail from the makers to the buyers. There was little chance for mistakes when the entire transaction was in the hands of a single responsible house.

Apply these first principles to modern business methods and you have the most efficient means of selling your goods overseas. Such an organization is at your disposal in the Federal Export Corporation. Its sales program covers every open territory abroad—it operates its own steamers—it forwards all shipments—it finances every sale—and it conducts its business so that it will develop on lines of permanent benefit to every manufacturer whose products we sell.

We invite correspondence from manufacturers who have received direct foreign inquiries for their products and who wish to be relieved of the details of selling and financing the orders which may be placed by these prospective buyers.

Write us for complete information.

FEDERAL EXPORT CORPORATION

115 Broadway, New York, U. S. A.

SHIPOWNERS, MANUFACTURERS' REPRESENTATIVES, BANKERS

liam Schroeder, W. L. McArron and Gus Guggenbichler are the incorporators.

PETOSKEY, MICH.—The Petoskey Portland Cement Co., organized with $1,000,000 capital, contemplates constructing a plant.

BENTON, ILL.—The United States Fuel Co. has let the general contract for a group of buildings to cost about $30,000 to Schmidt Bros. Construction Co., 105 North Clark street, Chicago.

PEORIA, ILL.—The Murphy Mfg. Co. has been incorporated in Delaware with $150,000 capital by Otto S. Murphy and A. L. Melvin, Chicago.

CHICAGO.—The National Electric Vending Co. has been incorporated in Delaware with $500,000 capital to manufacture automatic vending machines by B. T. Cowin, L. L. Cowin, and R. Montgomery.

CHICAGO. — Paul C. Loeber, 849 West Ohio street, will build a plant to manufacture ventilating apparatus.

CHICAGO.—The C. H. Hanson Co., 178 North Clark street, will build a 3-story factory addition, 50 x 100 feet, to cost $25,000 at 307 West Erie street.

CHICAGO.—The Monighan Foundry Co., 2135 Carroll avenue, will build a foundry addition, 92 x 96 feet. A. P. Weber, 10 South La Salle street, is architect.

CHICAGO.—The Scoville Pump Valve Co. has been incorporated with $35,000 by John H. Scoville, Edward C. Brown, and Amasa V. Scoville, of Riverside, Ill.

CHICAGO.—The Krasberg Mfg. Co., 412 Orleans street, tool manufacturer, will build a 4-story plant costing $150,000.

ELGIN, ILL.—The city has plans in preparation for a $60,000 structure on Kimball street. M. Brightman is city engineer.

OLIVE BRANCH, ILL. — The Egyptian Mineral Co. has been incorporated with $15,000 capital by O. S. Scott, W. B. Kirkham and D. L. Kirkham.

QUINCY, ILL. — The Electric Wheel Works will build a 1-story factory 90 x 200 feet. John A. Stillwell is president.

BLOOMINGTON, IND. — Options have been taken by Adam Beck, formerly of Princeton, Ind., on a site proposed for the location of a $200,000 cement plant.

FORT WAYNE, IND.—The General Electric Co. has awarded a contract to the Indiana Engineering & Construction Co. for one of the units of its plant at the contract price of $85,000.

INDIANAPOLIS, IND.—The Nordyke & Marmon Co. has commissioned Zettel & Rapp, Cincinnati, to draw up plans for additions to its automobile factory in Indianapolis. The initial building will be 200 x 300 feet, 1-story and of saw-tooth roof construction.

CINCINNATI. — The Franklin Die Tool Co. has been organized with $30,000 capital by Richard M. Baer, John F. Cahill and W. M. Jones.

CINCINNATI.—The George Roller Bearings Co. has been incorporated with $10,000 capital by Edward Ritchie, B. E. Moore, J. Laughlin, Walter H. Miller and A. L. Quill.

CLEVELAND. — The Eastern Ohio Coal Stripping & Mining Co. has been incorporated with $100,000 capital by B. F. Friedman, M. M. Prentice, F. E. Sturtevant, E. M. Bradley and H. Federman.

CLEVELAND.—George B. Ogle has filed application of plans for a $15,000 factory at 18300 Grace avenue.

CLEVELAND.—A contract for a $100,000 power and heating plant for the Cleveland art museum has been awarded to the Crowell-Lundoff-Little Co.

COLUMBUS, O.—The Pennsylvania railroad plans extensions and improvements to the locomotive repair department totaling $1,000,000.

DAYTON, O. — The La French Power Spark Plug Co. has been organized with $100,000 capital by E. A. Eastman and others.

FREMONT, O.—The Clauss Shear Co. has commenced construction work on an addition, 1-story, 40 x 160 feet.

LIMA, O.—The Lima Steel Casting Co. will erect a building 50 x 200 feet, to cost $10,000, on a site adjacent to their present building.

NEWCOMERSTOWN, O. — Heller Bros. Co. of Newark, N. J., has purchased the plant of the Rex File Co. and contemplates extensions.

PAINESVILLE, O.—The Erie Motor Co. has been incorporated with $25,000 capital by Frank B. Fultz, R. H. Senkheil, Willard J. Hays, W. B. Lutton and D. S. Conover.

TOLEDO, O.—The Bunting Brass & Bronze Co. has taken out a permit to erect a $14,000 addition to its factory on Spencer street.

WILLOUGHBY, O.—The J. H. R. Products Co. will build a 75 x 200-foot factory for the manufacture of chemicals.

LOUISVILLE, KY.—The Hart Mfg. Co. has been incorporated with $60,000 capital by T. W. Vinson, H. K. Colb, R. E. Gordon and L. N. Reeder.

OWENSBORO, KY.—The Franks-Tractor-Cultivator Co. has been chartered recently with $50,000 capital by W. L. Franks, W. O. Hoskins and W. W. Milan.

ACKERMAN, W. VA. — The Cumberland Portland Cement Co., W. L. Sperry, president, has let the contract for a 500-ton crushing plant to cost about $40,000.

HUNTINGTON, W. VA.—The Clay Products Co., recently incorporated with $100,000 capital will manufacture clay products.

Western and Intermountain Territory

AUSTIN, MINN.—Max Miller has plans in preparation for a 1-story, 50 x 108-foot manufacturing building. F. W. Kinney, Plymouth building, Minneapolis is the architect.

DULUTH, MINN.—The Ackerman Wheel Co., Cleveland, plans to build a $200,000 aeroplane factory. J. D. Park and associates of Duluth are interested.

FT. DODGE, IOWA. — The Ft. Dodge Auto Co., care Heath Bros., will build a 1-story factory 45 x 100 feet.

GRINNELL, IOWA.—The Lafflet Electric railway, recently incorporated with $350,000 capital plans a line from Pella to Wabasha. D. S. Umbenbeuer is president.

LAKE CITY, IOWA.—Lake City plans to install a fire pressure pump and deep well pump at the municipal water works station.

RICEVILLE, IOWA.—The city of Riceville has sold $60,000 worth of bonds for water works improvements. H. Moeller is city clerk.

JOPLIN, MO.—The Armond Mining Co., recently incorporated with $100,000 capital has plans in preparation for a 300-ton plant.

KANSAS CITY, MO. — The Butler Mfg. Co., 1324 Grand avenue, has plans for an addition 120 x 140 feet. Shepard, Farrar & Wiser, R. A. Long building, are the architects.

NECK CITY, MO. — The Northwestern Mines Co. is planning to build a 1000-ton concentrating plant for lead and zinc.

ST. LOUIS.—The Spring Wheel Co. has been incorporated with $100,000 capital by John D. Puff and R. H. Puff.

ABILENE, TEX. — The city of Abilene plans to install a water works pumping plant and make improvements to cost $500,000. W. A. Riney is city engineer.

FT. WORTH, TEX.—The city plans to expend about $85,000 on water works improvements. C. F. Crabtree is superintendent.

FT. WORTH, TEX.—G. W. Armstrong and associates have purchased a 600-acre site and will erect a reinforced concrete factory building to cost $150,000.

STAMFORD, TEX.—The Hydroelectric Metallic Battery Co. has been incorporated with $20,000 capital by C. L. Pittman, D. L. Humphrey, J. P. Johnson and others.

TOYAH, TEX.—The U. S. Sulphur Co., recently incorporated with $600,000 capital, plans to build a plant to cost about $300,000.

WACO, TEX.—C. H. Cox, chairman of the building committee, will take bids soon on a 196 x 200-foot, reinforced concrete building to cost about $50,000.

ADA, OKLA.—Bonds have been voted and plans now are being drawn for water works improvements to cost $100,000. E. S. Ratliff is mayor.

HOISINGTON, KANS.—The Connor Construction Co. has been awarded the contract for a water works system to cost about $80,000.

LARNED, KANS. — Bids are being taken by Herbert Dexter, county clerk, on a $100,000, 3-story, 90 x 114-foot court house.

LA CROSSE, KANS.—Bonds for $30,000 have been sold for a new water works system. W. B. Rollins & Co., Kansas City, Mo., are the engineers.

PARSONS, KANS.—Plans are being made for a water works system to cost $600,000. F. E. Workman is superintendent.

QUINTER, KANS.—A contract for a municipal electric light plant to cost $15,000 has been let to J. H. Lee, Plainville.

TIPTON, KANS.—The city of Tipton has voted $20,000 in bonds for a water works plant. G. P. Taylor, Stockton, is engineer.

OMAHA, NEBR.—The city will build a pumping station to cost $30,000.

BONESTEEL, S. DAK.—Plans are being made by Bruce & Standeven, engineers, Omaha, for water works and electric light plants at Bonesteel.

BURNS, WYO.—The city has sold bonds valued at $17,000 and will install a water works system and electric light plant.

DILLON, MONT.—The Chicago Milwaukee & St. Paul railroad is planning a line from Piedmont to Dillon, about 60 miles.

HANOVER, MONT. — The Three Forks Portland Cement Co. has awarded the general contract for a new plant to cost $100,000 to Rude & Searles, Great Falls.

LIVINGSTON, MONT. — About $100,000 will be expended by the Northern Pacific railroad in improving its yards here. The work includes a 1000-car capacity freight yard.

LIVINGSTON, MONT.—Bids are being received by H. J. Reese, city clerk, on a $225,000 water works system.

SALTESE, MONT. — All preliminary arrangements have been made for the construction of a 250-ton concentrating mill on the property of the Tarbox Mining Co. Richard Dixon is president of the company.

Iron and Steel Prices

Corrected to Tuesday noon

IRON ORE

Superior Ores, Per Ton, Lower Lake Ports.

Old range Bessemer, 55 iron	5.95
Mesabi Bessemer, 55 iron	5.70
Old range non-Bess., 51½ iron	5.20
Mesabi non-Bess., 51½ iron	5.05

Port Henry Ores, non-Bessemer, Per Unit, Delivered Eastern Pennsylvania.

Old Bed, crude 55 iron	10.50c to 11.00c
Old Bed., concent., 65 iron	11.00c to 11.50c
Harmony, concent., 63 iron	11.50c to 11.75c
Lump (at mines)	$5.75

WAREHOUSE PRICES

Steel bars, Chicago	4.50c
Steel bars, Cleveland	5.00c
Steel bars, Detroit	4.50c
Steel bars, Philadelphia	5.00c to 5.50c
Steel bars, New York	5.00c
Steel bars, St. Louis	4.55c
Steel bars, Cincinnati	4.65c
Steel bars, St. Paul	4.60c
Steel bars, over 2-in., Buffalo	4.50c
Steel bars, Buffalo	4.40c
Iron bars, Chicago	4.50c
Iron bars, Cleveland	4.95c
Iron bars, Detroit	4.50c
Iron bars, St. Louis	4.45c
Iron bars, Cincinnati	4.65c
Iron bars, Philadelphia	4.80c
Iron bars, New York	4.75c
Shapes, Chicago	5.00c
Shapes, Detroit	5.00c
Shapes, St. Louis	5.05c
Shapes, St. Paul	5.10c
Shapes, New York	5.25c
Shapes, Cleveland	5.25c
Shapes, Philadelphia	5.00c to 5.50c
Shapes, Buffalo	4.60c
Shapes, Cincinnati	5.00c
Plates, Chicago	7.00c to 8.00c
Plates, Detroit	8.00c
Plates, St. Louis	7.05c
Plates, St. Paul	7.10c
Plates, New York	9.00c
Plates, Cleveland	7.50c
Plates, Philadelphia	9.50c to 10.00c
Plates, Cincinnati	9.00c
No. 10 blue anl. sheets, Chi.	9.50c
No. 10 blue anl. sheets, Cleve.	8.25c
No. 10 blue annealed, Buffalo	4.50c
No. 10 blue anl. sheets, St. L.	9.55c
No. 10 blue anl. sheets, Cinci.	9.00c
No. 10 blue anl. sheets, St. Paul	9.60c
No. 10 blue annealed, Detroit	8.00c
No. 28 black sheets, Chicago	9.50c
No. 28 black sheets, Cleve.	9.00c
No. 28 black sheets, Cincin.	8.15c
No. 28 black, Detroit	8.00c
Ni. 28 black sheets, St. L.	9.35c to 9.55c
No. 28 black sheets, St. Paul	9.60c
No. 28 galv. sheets, Chicago.	11.00c
No. 28 galv. sheets, Cleve.	10.50c
No. 28 galv. sheets, Cincin.	10.15c
No. 28 galvanized, Detroit	11.00c
No. 28 galv. sheets, St. L.	10.40c to 11.25c
Hoops, Cleveland	6.00c
Hoops, Detroit	6.00c

IRON AND STEEL SCRAP

STEEL WORKS USE

(Gross Tons)

Bundled sheets, Pittsburgh	$26.00 to 27.00
Bundled sheets, Cleveland	25.00 to 27.00
Bundled sheets, Buffalo	16.50 to 17.00
City wrought, short, N. Y.	35.00
Frogs, switches, guards, St. L.	40.00 to 42.00
Heavy melting steel, Pitts.	44.00 to 47.00
Heavy melting steel, Buffalo	40.00 to 41.00
Heavy melting steel, Chicago	40.00 to 41.00
Heavy melt'g steel, Cleveland	41.00 to 43.00
Heavy melting steel, Cinci.	37.50 to 38.00
Heavy melting steel, east. Pa.	39.00 to 40.00
Heavy melt'g steel New York	30.00
Heavy melting steel, St. L.	44.00 to 45.00
Heavy melt'g steel, Birming.	24.00 to 26.00
Hydraulic pressed sh'ts, Cleve.	30.00 to 31.00
Hydraulic press. sheets, Pitts.	35.00
Hydraulic pressed sheets, Chgo.	31.00 to 32.00
Low phos. steel, Buffalo	50.00 to 55.00
Low phos. steel, Pittsburgh.	55.00 to 60.00
Low phos. steel, eastern Pa.	56.00 to 58.00
Shoveling steel, Chgo.	38.50 to 39.50
Shoveling steel, St. Louis	36.00 to 37.50
Steel rails, short, Chicago	50.00 to 52.00
Steel rails, short, Cleveland.	44.00 to 45.00
Steel rails, short, St. Louis	45.00 to 47.00
Steel rails, old, Birmingham.	30.00 to 31.00
Stove plate, Cincinnati	19.75 to 20.00
Stove plate, St. Louis	22.00 to 23.50
Stove plates, N. J. points	22.00
Stove plate, Birmingham	15.50 to 16.50
Stove plate, Buffalo	18.00 to 18.50
Stove plate, eastern Pa.	23.00 to 24.00
Stove plate, Pittsburgh	25.00

(Net Tons)

Boiler plate, cut, No. 1, Chgo.	27.00 to 28.00
Boiler plate, cut, No. 1, St. L.	24.00 to 25.00
Bundled sheet, Cincinnati	23.00 to 23.50
Knuckles, coup., Chicago	43.00 to 44.00
Knuckles, coup., St. Louis	36.00 to 37.00
Springs, Chicago	44.00 to 45.00
Stove plate, Chicago	24.50 to 25.00
Stove plate, Cleveland	20.00 to 21.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Minneapolis, St. Paul	4.54
Buffalo to:	
Albany, N. Y.	$1.26
New England (rail)	2.58
New York and Brooklyn (rail)	2.58
Virginia furnaces to:	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
Minneapolis, St. Paul	5.85
New York (r. and w.)	4.25
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
St. Louis	3.40
Chicago to:	
Des Moines	$2.80
Milwaukee	.50
Minneapolis, St. Paul	2.00
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58
Minneapolis, St. Paul	4.54
Duluth, Minn., to:	
Minneapolis-St. Paul	$1.25
Mayville, Wis.:	
Minneapolis-St. Paul	$1.75

Freight Rates, Finished Material

Pittsburgh, carloads, per 100 lbs., to:	
New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Detroit	15.7 cents
Minneapolis and St. Paul	32.9 cents
Denver	83.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama	61.0 cents

IRON MILL USE

(Gross Tons)

Busheling No. 1, Buffalo	27.00 to 28.00
Busheling, No. 2, Buffalo	18.00 to 19.00
Busheling, No. 1, Pittsburgh	27.00 to 28.00
Cast borings, New York	21.50 to 22.00
Cast borings, eastern Pa.	22.00 to 22.50
Cast borings, Buffalo	14.50 to 15.00
Cast borings, Pittsburgh	24.00 to 26.00
City wrgt., long, New York	40.00
Forge flashings, small, Cleve.	30.00 to 31.00
Forge flashings, large, Cleve.	30.00 to 31.00
Forge, No. 1, eastern Pa.	26.00 to 28.00
Grate bars, Buffalo	18.00 to 18.50
Grate bars, N. J. points	20.00
Iron axles, Pittsburgh	55.00 to 60.00
Iron axles, Cincinnati	46.00 to 46.50
Iron axles, eastern Pa.	50.00 to 55.00
Iron axles, Buffalo	50.00
Iron rails, Chicago	50.00 to 52.00
Iron rails, Buffalo	29.50 to 30.00
Iron rails, Cincinnati	36.00 to 36.50
Iron rails, St. Louis	46.00 to 47.50
Iron rails, Cleveland	45.00 to 47.00
Machine turnings, Buffalo	17.00 to 18.00
Machine shop turnings, N. Y.	20.00
Mach. shop turnings, Pitts.	24.00 to 26.00
Mch. shop turnings, east. Pa.	21.50 to 22.00
Machine turnings, Birming.	12.00 to 13.00
R. R., mch. cast, No. 1, Buff.	30.00 to 31.00
R. R. wrought, 1, Buffalo	44.00 to 45.00
R. R. wrgt., No. 1, east. Pa.	55.00 to 60.00
R. R. wrought, No. 1, Pitts.	45.00 to 50.00
R. R. wrought, 1, B'ham.	31.00 to 32.00
Wrought pipe, Buffalo	31.00 to 32.00
Wrought pipe, eastern Pa.	40.00 to 42.00
Wrought pipe, New York	38.00

(Net Tons)

Angle bars, iron, Chicago	$49.00 to 50.00
Angle bars, steel, St. Louis	39.00 to 40.00
Arch bars & transoms, St. L.	44.00 to 45.00
Arch bars & transoms, Chgo.	50.00 to 52.00
Busheling, No. 1, Chicago	35.00 to 36.00
Busheling, No. 1, Cincinnati	22.00 to 22.50
Busheling, No. 1, Cleveland	26.00 to 27.00
Busheling, No. 1, St. Louis	27.50 to 28.50
Busheling, No. 2, Chicago	28.00 to 29.00
Cast borings, Cincinnati	14.00 to 14.50
Cast borings, Cleveland	21.00 to 22.50
Cast borings, St. Louis	17.00 to 17.50
Cast borings, Chicago	19.00 to 20.00
Cut forge, Chicago	43.00 to 44.00
Grate bars, Cleveland	20.50 to 21.50
Iron axles, St. Louis	49.00 to 50.00
Iron axles, Chicago	58.00 to 59.00
Iron axles, Cleveland	52.00 to 53.00
Machine shop turnings, Chgo.	19.00 to 20.00
Mach. shop turnings, Cleve.	17.00 to 18.00
Machine shop turn'gs, Cinci.	14.00 to 14.50
Mach. shop turnings, St. L.	18.50 to 19.00
Pipes and flues, Cleveland	28.00 to 29.00
Pipes and flues, Chicago	31.00 to 32.00
Pipes and flues, St. Louis	25.00 to 25.50
Railroad wrought, 1, Cleve.	43.00 to 44.00
Railroad wrgt., No. 1, Chgo.	44.00 to 45.00
Railroad wrought, 1, Cinci.	36.00 to 36.50
Railroad wrought, 1, St. L.	40.00 to 41.00
Railroad wrgt., No. 2, Chgo.	43.00 to 44.00
Railroad wrought, 2, St. L.	38.00 to 39.00

IRON OR STEEL WORKS USE

(Gross Tons)

Axle turnings, Cleveland	$23.00 to 24.00
Axle turnings, Buffalo	22.00 to 23.00
Shafting, New York	50.00
Shafting, eastern Pa.	48.00 to 52.00
Steel car axles, Birmingham.	40.00 to 41.00
Steel car axles, New York	58.00
Steel car axles, Buffalo	50.00
Steel car axles, Cleveland	54.00 to 55.00
Steel car axles, Pittsburgh	55.00 to 60.00
Steel car axles, eastern Pa.	50.00 to 55.00

(Net Tons)

Shafting, St. Louis	39.00 to 40.00
Steel car axles, St. Louis	49.00 to 50.00
Steel car axles, Chicago	54.00 to 56.00

IRON FOUNDRY USE

(Gross Tons)

Car wheels, (iron), Pitts.	$43.00 to 45.00
Car wheels, (steel), Pitts.	50.00
Car wheels, Chicago	40.00 to 42.00
Car wheels, eastern Pa.	33.00 to 35.00
Car wheels, Buffalo	31.00 to 32.00
Car wheels, New York	33.00 to 35.00
Car wheels, St. Louis	36.00 to 36.50
Car wheels, Birmingham	27.00 to 28.00
Car wheels, Cleveland	34.00 to 35.00
Tram car wheels, Birming.	24.00 to 26.00
Cast, 1, heavy, N. J. points.	35.00
Cast, 1 machy., N. J. points	40.00
Cast, No. 1, eastern Pa.	39.00 to 41.00
Cast, No. 1, Pittsburgh	35.00 to 38.00
Cast, No. 1, Birmingham	27.50 to 28.50
Malleable railroad, Cincinnati	21.50 to 22.00
Malleable railroad, Cleveland	37.00 to 38.00
Malleable railroad, Buffalo	34.00 to 35.00
Malleable railroad, Pittsburgh	30.00 to 32.00
Malleable railroad, east. Pa.	32.00 to 34.00

(Net Tons)

Cast No. 1, Cleveland	32.00 to 33.00
Cast, No. 1, Chicago	32.50 to 33.00
Cast, No. 1, Cincinnati	29.00 to 29.50
Cast, No. 1, St. Louis	30.00 to 31.00
Malleable railroad, Chicago	34.00 to 35.00
Malleable railroad, St. Louis	27.00 to 28.00
Malleable agricultural, Chgo.	28.50 to 29.50

MISCELLANEOUS USES

(Gross Tons)

Reroll. rails, 5 ft. & ov., Pitts.	50.00 to 55.00
Reroll. rails, 5 ft. & ov., Chgo.	50.00 to 53.00
Reroll. rails, 5 ft. & ov., E. Pa.	50.00 to 55.00
Reroll. rails, 5 ft. & ov., St. L.	50.00 to 55.00
Reroll. rails, 5 ft. or ov., Cleve.	46.00 to 47.00
Rerolling rails, long, Birming.	31.00 to 32.00

(Net Tons)

Boiler punchings, Chicago	41.50 to 42.00
Locomotive tires, Chicago	50.00 to 51.00
Locomotive tires, St. Louis	47.00 to 48.00

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A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

ACETYLENE IN CYLINDERS.

Linde Air Products Co., New York City.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

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Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

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American Steel & Wire Co., Chicago, Ill.

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Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Bourne-Fuller Co., The, Cleveland ,O.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Haynes Stellite Co., The, Kokomo, Ind.
Standard Alloys Company, Pittsburgh, Pa.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
United Alloys Steel Corp., The, Canton, O.

ALUMINUM (Granulated).

United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM (Solder).

United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM (Vanadium).

American Vanadium Co., Pittsburgh, Pa.

ALUMINUM ALLOYS.

United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM INGOTS.

Pittsburgh Aluminum Co., Pittsburgh, Pa.
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM RODS (Sheet).

United Smelt'g & Alum. Co., New Haven, Ct.

ANGLES, TEES, CHANNELS (See Steel Structural).

ANNEALERS (Pot and Muffle).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

ANNEALING BOXES AND POTS.

Blackwood Steel Fdy. Co., The, Springfield, O.
Garwood Bronze & Iron Works, Garwood, N. J.
Knox Pressed & Welded Steel Co., Pittsburgh.
Mesta Machine Co., Pittsburgh, Pa.
Pittsburgh Annealing Box Co., Pittsburgh, Pa.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Smith, Geo. H., Steel Casting Co., Milwaukee.
United Engrg. & Foundry Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

ANTI-SLIP TREADS FOR STAIRS.

Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

ARCHITECTURAL SHAPES.

Empire Art Metal Co., College Pt., N. Y.

ARMATURES.

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Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ASH BUCKETS.

Lakewood Engrg. Co., Cleveland, O.

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American Steel & Wire Co., Chicago, Ill.

AUTO TRUCKS.

Federal Motor Truck Co., Detroit, Mich.

AXLES.

American Bridge Co., New York City.
American Steel Export Co., New York City.
Bay City Forge Co., Erie, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
Illinois Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.

AXLE LATHES.

Bridgeford Mch. Tool Wks., Rochester, N. Y.

BABBITT METAL.

Keystone Bronze Co., Pittsburgh, Pa.
Lubricating Metal Co., The, New York City.
Ryerson, Jos. T., & Son, Chicago, Ill.

BAKERS, WIRE COATING.

Morgan Construction Co., Worcester, Mass.

BAKERS (Wire Coating and Bluing).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALE TIES.

American Steel & Wire Co., Chicago, Ill.

BALLS (Brass and Bronze).

Auburn Ball Bearing Co. Rochester, N. Y.

BALLS (Steel).

Auburn Ball Bearing Co., Rochester, N. Y.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
New Departure Mfg. Co., Bristol, Conn.

BANDERS (Hydraulic for Projectiles).

Southwark Foundry & Mch. Co., Philadelphia.

BAND (Steel).

Akron-Selle Co., The, Akron, O.
Carnegie Steel Co., Pittsburgh, Pa.
Interstate Iron & Steel Co., Chicago, Ill.

BARBED WIRE FENCE (Equipment).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARGES (Steel).

American Bridge Co., New York City.

BARS (Concrete Reinforcing).

Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Texas Rolling Mill Co., Fort Worth, Texas.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.

BARS (Iron and Steel).

American Bridge Co., New York, N. Y.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Federal Export Corporation, New York City.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Texas Rolling Mill Co., Fort Worth, Texas.
Trussed Concrete Steel Co., Detroit, Mich.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Westerman & Co., Lockport, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O

BARS (Tin).

Andrews Steel Co. Newport, Ky.

BASE PLUGS.

Bogert & Hopper, New York City.

BEAMS, CHANNELS AND ANGLES.

American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Empire Art Metal Co., College Pt., N. Y.
Federal Export Corporation, New York City.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

BEARINGS (Ball).

Auburn Ball Bearing Co., Rochester, N. Y.
New Departure Mfg. Co., Bristol, Conn.

BEARINGS (Ball Thrust).

Auburn Ball Bearing Co., Rochester, N. Y.

BEARINGS (Vanadium Steel).

American Vanadium Co., The, Pittsburgh, Pa.

BELT CEMENT AND DRESSING.

Dixon, Jos., Crucible Co., Jersey City, N. J.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.

BELT LACING (Leather).

Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BELTING (Chain).

Link-Belt Company, Chicago, Ill.

BELTING (Leather).

Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.

BENCHES (Steel).

New Britain Mach. Co., New Britain, Conn.

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HIGH SPEED
AND OTHER
Firth-Sterling
TOOL STEELS

The knowledge, experience and skill of Sheffield combined with the best Pittsburgh practice have made these steels the Standards of Quality and Uniformity wherever tools are used.

Firth-Sterling Steel Company
McKEESPORT, PA.
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Cleveland Pittsburgh

Investigate
THE HAGAN
Steam Jet Ash Conveyor

The **"Hagan"** is a combination of all the good points of **other** Steam Jet Conveyors, scientifically worked in with a number of **"Hagan" Special Features.**
The result is a Steam Jet Ash Conveyor that will out-service all others in **every** particular.

The Hagan can't waste your steam unless you consent to it!

This point ***alone*** is a ***Decisive*** Feature.
HAGAN GUARANTEES INSURE
Service—Efficiency—Economy
They have backed the operation of over 5,000 Stokers sold in the last three years.
Ask us to send you our Bulletins.

GEORGE J. HAGAN CO.
4th Floor Peoples Bank Bldg.
PITTSBURGH, PA.
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FOUNDRY BASIC
IRON ORES

WHARTON STEEL CO.
120 BROADWAY NEW YORK, N.Y.
Furnaces and Mines Wharton, N. J.

ILLINOIS ILLINOIS

Illinois Steel Company

GENERAL OFFICES

208 South La Salle Street

CHICAGO, ILLINOIS

AXLES

MASTER CAR BUILDERS' STANDARD

Car Engine Truck Tender
A. S. & I. R. Motor
Driving, Trailing *and* Special Design

Most modern methods of manufacture assure more than a **Satisfactory Product.** Extreme care in **Finishing** and **Inspection** is double assurance of satisfaction to you. If for no other reason, your natural desire to promote **Safety to Life and Property** compels you to use only the best.

Send us your inquiries and apply for further particulars.

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Buffalo: Marine National Bank Bldg.
Cincinnati: Union Trust Bldg.
Cleveland: Rockefeller Bldg.
Denver: First National Bank Bldg.
Detroit: Ford Bldg.
New York: Hudson Terminal Bldg.
New Orleans: Maison Blanche
Philadelphia: Widener Bldg.
Pittsburgh: Carnegie Bldg.
St. Louis: 3rd National Bank Bldg.
St. Paul: Pioneer Bldg.

Pacific Coast Representatives: U. S. Steel Products Co., San Francisco, Seattle, Portland, Los Angeles.
Export Representatives: U. S. Steel Products Co., New York City.

ILLINOIS ILLINOIS

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Y STEEL I BRAND PIPE STAR IRON BRAND

NEW PROCESS PATENTED YOUNGSTOWN, OHIO GALVANIZED SHEETS

YOUNGSTOWN

Business Builders

Pipe is our principal product although we make many other things and make them all as well as it can be done.

The quality of all our products is enhanced by unusual facilities and large output, which permit the selection of special steel for each of them.

This and the constant care devoted to producing the best that is commercially possible have built the reputation of steel materials bearing our name. These conditions have also helped to make ours the largest independent pipe mills in the world.

The Youngstown Sheet & Tube Company
Youngstown, Ohio

DOUBLE REFINED PUDDLED IRON ROOFING

DISTRICT SALES OFFICES

NEW YORK CITY — PHILADELPHIA, PA.
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PITTSBURG, PA. — DENVER, COLO.
DALLAS, TEX. — SAN FRANCISCO, CAL.
ST. LOUIS, MO. — SEATTLE, WASH.
ATLANTA, GA.

BUCKEYE FENCE

Say you saw it in THE IRON TRADE REVIEW

Steel for Service

WHEN a shop performs work on semi-finished steel from which it expects certain results, but does not secure them, the fault may be due not so much to the quality of the steel as to the treatment the semi-finished product receives in the shop. A change in the specifications of the steel might give very different and satisfactory results.

The wide experience the metallurgists and engineers of this company have had both in the manufacture of steel and in the use of the semi-finished product very often renders this advice extremely valuable.

Such advice can be had for the asking and might save many a manufacturer annoyance and money.

The mark of quality

It protects the user

Carnegie Steel Company

General Offices: Pittsburgh, Pa.

890

Independence Day
July 4th, 1917
To commemorate the 141st anniversary of the signing of the Declaration of Independence and the trying days which marked the birth of a new nation; to keep fresh the memory of those patriots who, not only during the revolution but in the years since, have kept alive the ideals of true Americanism; to signalize the re-awakening of the Spirit of Freedom; we set apart this space.
THE MIDVALE STEEL COMPANY
CAMBRIA STEEL COMPANY
WORTH BROTHERS COMPANY
General Offices: Widener Building, Philadelphia
DISTRICT SALES OFFICES:
Atlanta Boston Chicago Cincinnati Cleveland Detroit Seattle
New York Pittsburgh Philadelphia San Francisco St. Louis Salt Lake City

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STEEL SHAPES
ANGLES, TUBES
CHANNELS
MOULDINGS

REQUIRED IN THE
CONSTRUCTION OF

STEEL CARS BUILDINGS
AGRICULTURAL
MACHINERY
STEAMSHIPS

AND FOR EVERY OTHER PURPOSE
WHERE STEEL IS USED

THE EMPIRE ART METAL CO., Inc.
COLLEGE POINT, N. Y.

EMP IRE

Products of Character, Individuality and Reputation Are Made Only from Materials of Quality

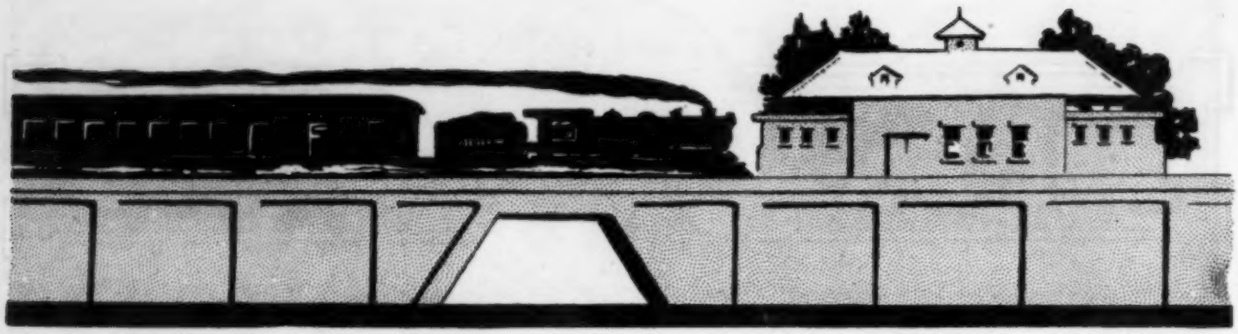
Empire Steel Tubing

is a high grade steel tubing especially adaptable in the manufacture of Automobiles, Auto Trucks, Aeroplanes, Motor-cycles, Bicycles, Beds, Baby Carriages, Tricycles, Velocipedes, Pumps, etc.

Made round or square with welded, lock or open seams

THE EMPIRE ART METAL CO., Inc.
COLLEGE POINT, N. Y.

Say you saw it in THE IRON TRADE REVIEW



Concrete Reinforcing Bars
for All Kinds of Construction Work

The most important factor in concrete reinforcement is the tensile strength and elastic limit of the reinforcing bar.

Other things being equal, steel having the highest elastic limit, or yield point, will be the most satisfactory for reinforcement. When under strain, as soon as the elastic limit of any reinforcing bar is reached, the metal stretches, rapidly decreasing in section, drawing loose from the concrete and destroying the monolithic bond existing before this point is reached. Therefore, the safety of the entire construction is in direct proportion to the elastic limit of the steel used.

The elastic limit of rail carbon steel is 50,000 to 60,000 pounds per square inch, either twisted or plain, as compared with an elastic limit of 25,000 to 30,000 pounds in soft steel.

That's why rail carbon steel, with its 80,000 pounds minimum tensile strength, is recommended as being far superior for all kinds of reinforced concrete work.

At our Marion, Ohio, works we buy select rails, and roll them into rail carbon steel reinforcing bars—in a plant which is the embodiment of the latest thought and practice.

These bars can be supplied from stock in various sizes, lengths and shapes. We can also roll special shapes and sizes to fit your particular requirements.

INTERSTATE IRON & STEEL COMPANY

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"I take pleasure in informing you that many of the more important working parts of the Lewis machine gun are made of VANADIUM STEEL which has proved to be more satisfactory for the severe service required than any other kind of steel I have tried.

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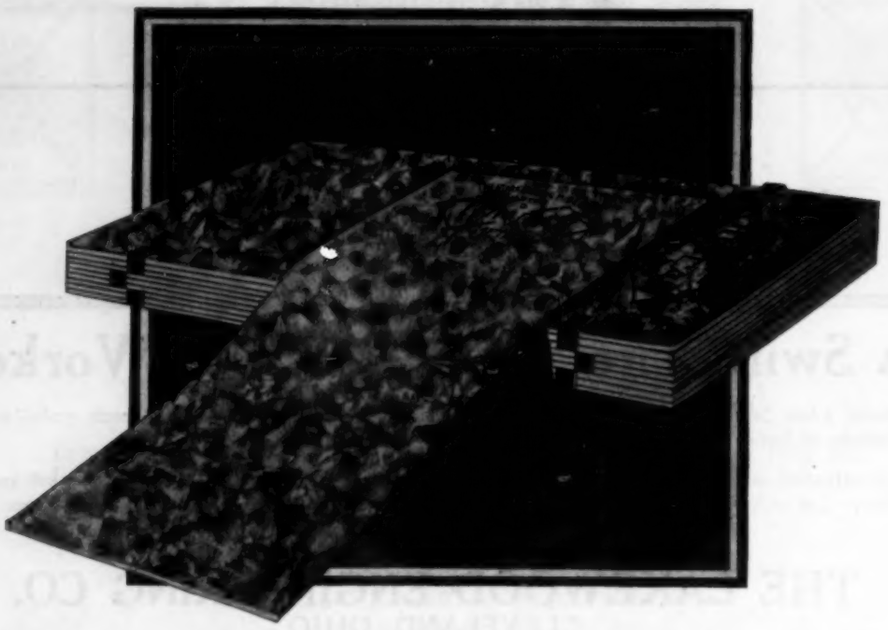
For over eighteen years we have specialized in the construction of buckets, steel cars and trucks for all industrial purposes.



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RESISTS CORROSION

TITANIUM TALKS

No. 14

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May Figures— 29,502 Tons of Keystone

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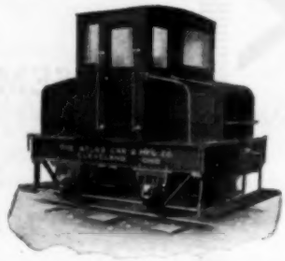

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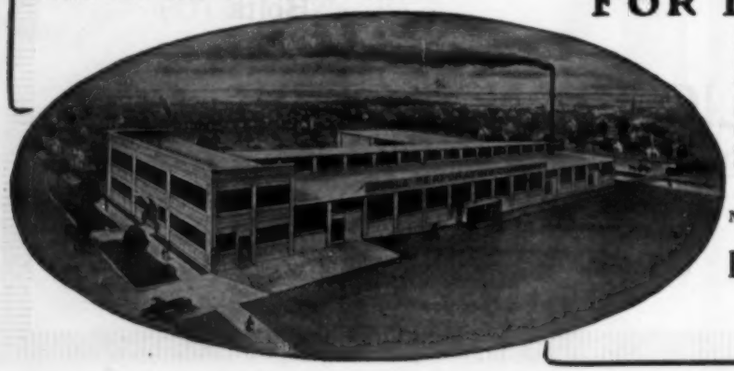

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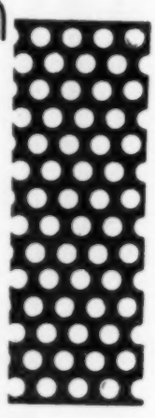

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Lackawanna Steel Company

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A New Chain-Pipe Wrench
by the
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The above cut shows the wrench in its two positions

which, for the first time in the construction of this type of wrench, accomplishes reversibility of action—works either way without disengaging and turning.

The Billings Chain-Pipe Wrench, because of its new and exclusive feature, saves many an hour and solves many an awkward situation. Read the facts:

The important and exclusive feature of this wrench is its double-action or reversibility. Pipe can be turned in either direction without the process of removing and turning over the wrench. This is due to the angular position of the elliptical jaws, which allows the engagement of either the outer or inner teeth. The combination feature of this wrench consists of its adaptability to pipe fittings and short connections, as well as ordinary pipe. By removing the outside elliptical jaws, thereby bringing into play the narrow jaw attached to the under part of the handle, the wrench is immediately converted into an efficient tool for narrow or irregular work where a broader wrench would be ineffectual.

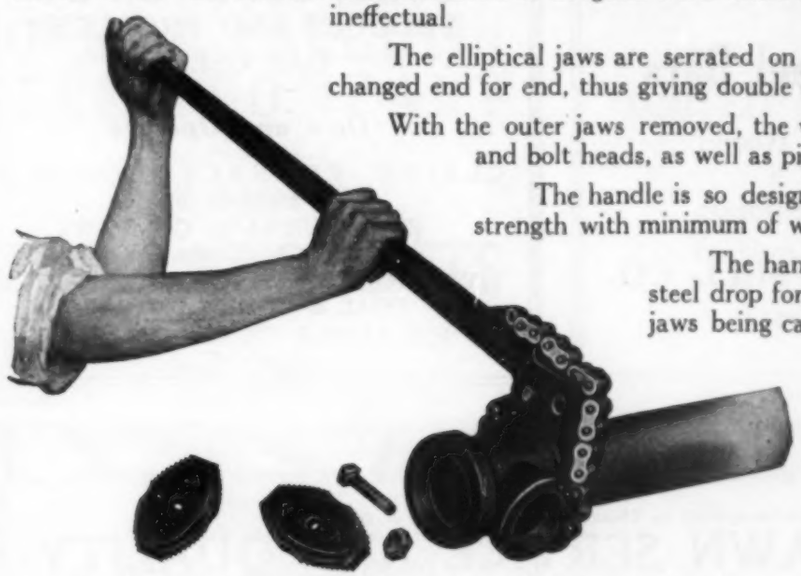
The elliptical jaws are serrated on all sides and may be easily changed end for end, thus giving double life to the wrench.

With the outer jaws removed, the wrench is available for nut and bolt heads, as well as pipe fittings.

The handle is so designed as to give the necessary strength with minimum of weight.

The handle and jaws are made from steel drop forging of superior quality, the jaws being carefully hardened. All parts are interchangeable.

The tool is made with either a flat link or cable chain. The chains are made in our own factory, and are of sufficient safety test to insure an absolutely reliable tool.



The above cut shows the wrench as adapted to fitting nipples, etc.

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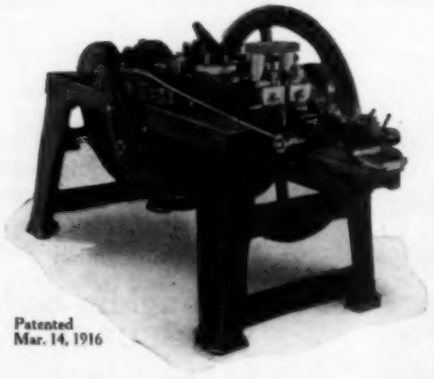

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MACHINE CARRIAGE BOLTS TRACK BRIDGE

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Pulverizing
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will give you the kind of results you want on such industrial furnaces as

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This is not an experiment but an established fact, when you use Raymond Mills to grind the coal, as we have a large number of customers successfully using this form of fuel.

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"Milton" Semi-Finished

Being faced at right angle with thread supplies a tight contact surface against the machine. All sizes.

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Sink Bolts, Closet Screws, Complete Line of Machine Screws Boxed for the Hardware Trade. Threaded Wires

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Estimates gladly furnished *State quantity and submit samples*

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Increased Efficiency and Greater Output Per Turn are Assured, if You Install

BAIRD WATER COOLED STANDINGS

The standings that have revolutionized HOT MILL Work.

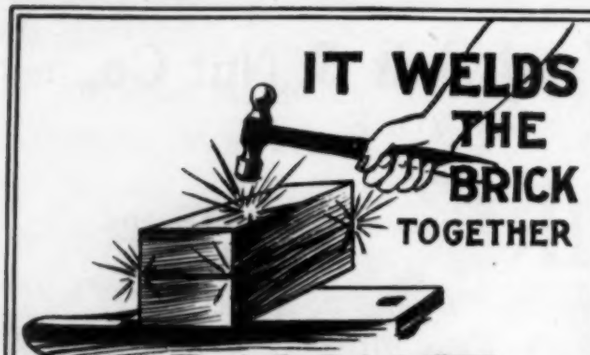
Baird Water Cooled Standings are TEMPERATURE CONTROLLED Standings, and can be regulated to a temperature suitable to either summer or winter weather. Your men will never be troubled with over-heated, scalded or cold feet while working upon them. These Standings may be installed without changing the present layout of your mill.

If you wish a cool, comfortable mill—a mill in which your men will work with a vim and vigor on the hottest summer days, install BAIRD WATER COOLED STANDINGS.

NATIONAL ROLL & FOUNDRY CO.

Rolling Mill Specialists

AVONMORE, PENNSYLVANIA



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Write at once for sample and full particulars

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Fire Proof Building Bricks

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(CRYSTALLINE PRODUCT)

Crude, Calcined, and Dead Burned

equal to Austrian, Grecian, etc.

Any desired percentage of

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Lime, Silica, Iron and Alumina can be guaranteed

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SHIPPERS FROM ALL DISTRICTS TO ALL TIDEWATER AND RAIL POINTS

The Reason

so many plants have insulated their high temperature equipment with

SIL-O-CEL
PREVENTS HEAT PENETRATION
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MADE FROM CELITE

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Increases Plant Capacity

The proper insulation of your heated equipment with SIL-O-CEL will materially increase the productive capacity of your plant and at the same time will effect a saving in fuel.

Let us submit Blue Prints showing methods of applying SIL-O-CEL Heat Insulation.

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When Repairs Are Necessary on Furnace or Cupola Linings, Keep in Mind

DIXON'S FURNACE CEMENT

(Crucible Clay and Graphite Mixture)

Its superiority for this class of work has been proven by many years of satisfactory service.

Then, too, it's handy to have around for lining ladles, making tap-hole mixture and similar foundry requirements.

Price and folder No. 64-V on request.

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FOUNDED 1859 ADDY INCORPORATED 1915

Write our nearest office

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Mr. Schwab says:

"The great salesman must have profoundly at heart the interests of his customer, for no business can develop except as it promotes the interests of those who use its goods or its services. In salesmanship the greatest possible unselfishness is the most enlightened selfishness."

Here in a few words are the principles on which we try to conduct our business.

PIG IRON **COKE** **COAL**

J. H. Hillman & Sons Company

OLIVER BUILDING PITTSBURGH, PA.

Standard Low Sulphur CONNELLSVILLE COKE

FOR

Blast Furnaces and Foundries

Shipments 3,000,000 Tons Annually. Daily Shipments 10,000 Tons
Any Railroad Delivery

ADAMITE

PATENTED

for Best Service & Highest Efficiency

A Great Diversity of Uses

"Adamite" has been proven best—the *ideal* material from which to manufacture the following products, as it means maximum efficiency:

Rolls, for mills of all kinds.
Rolls, welding.
Rolls, sizing.
Rolls, straightening.
Dies, drawing rings for gas cylinders, shrapnel cases, etc.
Dies, forging.
Dies, bending.
Dies, hammer.
Guides for wire, rod, and billet mills.
Brake shoes.
Cylinder liner plates.
Piercing points, plugs and balls for tube mills.
Pinions. Gears.
Coupling boxes.
Plungers for Pumps.
Crusher jaws.
Cement mill rolls, rings, tires and liner plates.
Locomotive wheels.
Car wheels.
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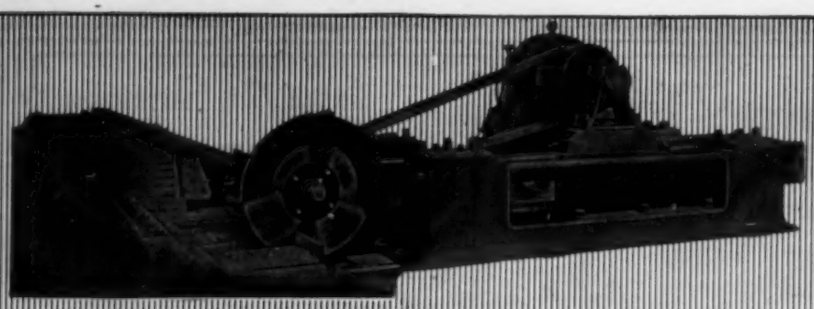
Anti-slip treads for stairs.
Special machine tools.

We are continuously finding, and having brought to our attention new uses for **"Adamite"**—places where our material will replace steel or other metal parts with profit to the buyer and user. In the majority of manufacturing plants of all kinds, there are *some* uses for **"Adamite"** castings.

Which products are you most interested in, now? Check the list above, tear out and mail this advertisement today, and we will send the General "Adamite" Catalog, containing much of interest and value to you.

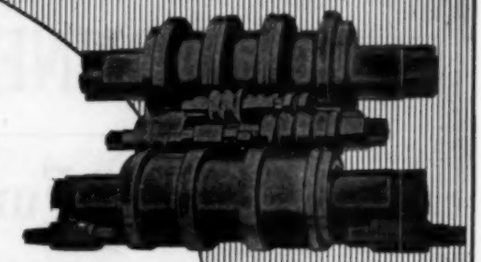
Pittsburgh Iron & Steel Foundries Co.

Sales Offices, PITTSBURGH General Offices and Foundries, MIDLAND, PA.



Horizontal Saw for heavy sections, hot or cold.

Mackintosh-Hemphill Equipment for Iron and Steel Works



CASTINGS: We make a specialty of heavy Steel Gears, Pinions and Steel Rolls, in the greatest variety for rolling mills, and have unexcelled foundry, pattern shop and laboratory facilities for such work. We call special attention to our

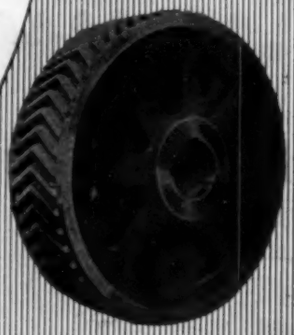
Write for information about our Superior Steel and Manganite Rolls.

MANGANITE ROLLS: (steel alloy) superior strength and wearing qualities. Recommended as productive of greater tonnage at lower mill costs, in Blooming Mills, Billet, Structural and Continuous Mills, and for Sheet Mill roughing rolls.

ROLLING MILLS: This line includes all type and sizes of Blooming Mills, Universal Mills for slabs and plates, Structural and Rail Mills, Plate, Sheet and Merchant Mills.

MISCELLANEOUS MACHINERY: Hot or cold metal saws of different types, sliding or tilting; Punches and Shears; Hydraulic Presses; Accumulators; Intensifiers; Bending Machines and Riveters; large Flywheels and Pulleys for belt or rope drive.

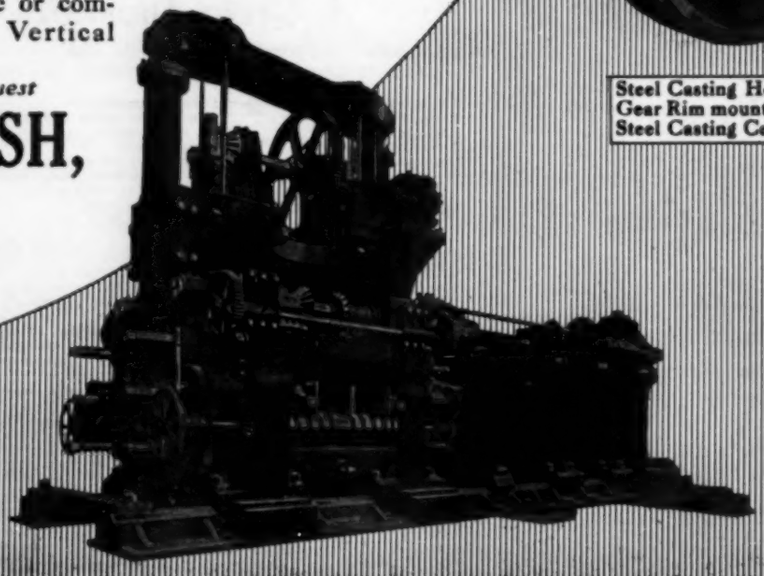
ENGINES: Simple Engines, condensing or non-condensing, with either piston or Corliss Valves. Reversing Engines, twin or three cylinder, simple or compound. Horizontal or Vertical Blowing Engines.



Steel Casting Helical Gear Rim mounted on Steel Casting Center.

Catalogue Free on Request

MACKINTOSH, HEMPHILL AND COMPANY
Pittsburgh, Pa.



27-inch Universal Plate Mill, built for the Youngstown Sheet and Tube Co.

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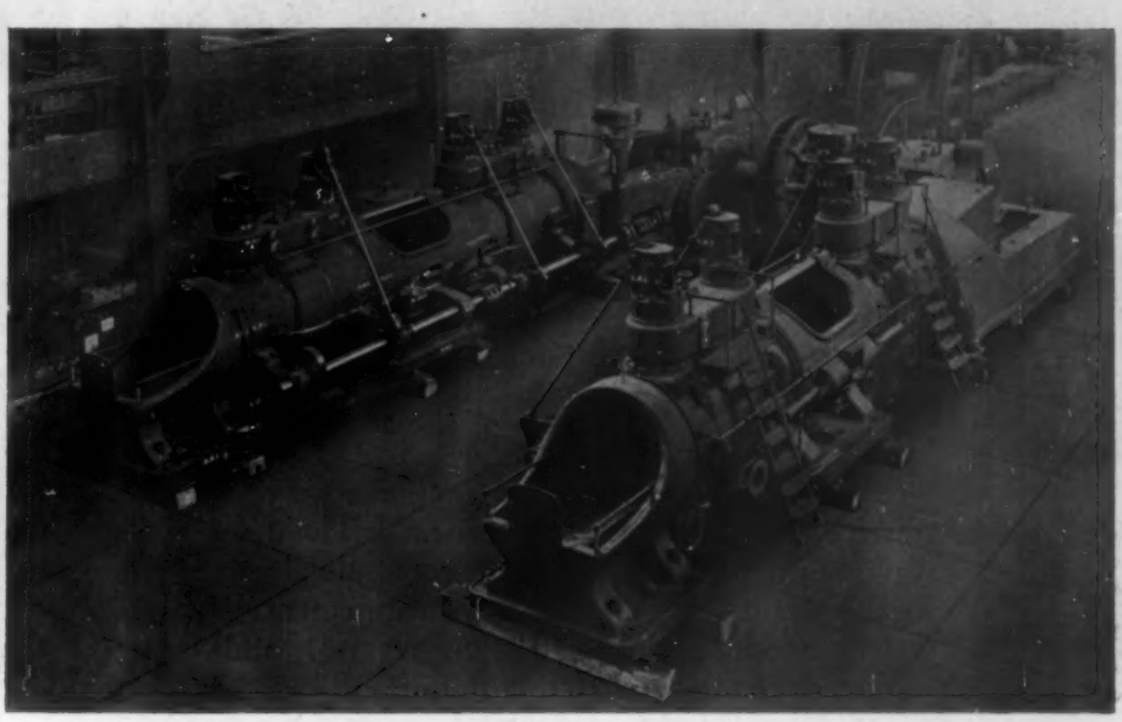
ONE MESTA 28" x 36" TWIN TANDEM HORIZONTAL GAS ENGINE

DIRECT CONNECTED TO 1750 K.V.A. 60 CYCLE GENERATOR



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Low Cost of Attendance, Depreciation and Repairs.
High Mechanical and Thermal Efficiency.
Positive and Correct Regulation by simplest means.

Write for complete information

MESTA MACHINE COMPANY

P. O. BOX 1124
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Rolling Mill Engines

The Tod Compound Reversing Engines

are the latest development in engines for this service and are *the most economical.* The new valve control gear effects a very economical use of the steam and the patented arrangement of valves produces a very quick reversal and reduces the idle strokes to a minimum.

The cost of maintenance is very small, due to the close coupling reducing the strains and to the simple construction and liberal proportions of the parts.

The William Tod Company

YOUNGSTOWN, OHIO

ENGINES—Mill, Reversing, Blowing, Gas, Pumping
ROLLING MILLS SPECIAL MACHINERY
HYDRAULIC FORGING PRESSES

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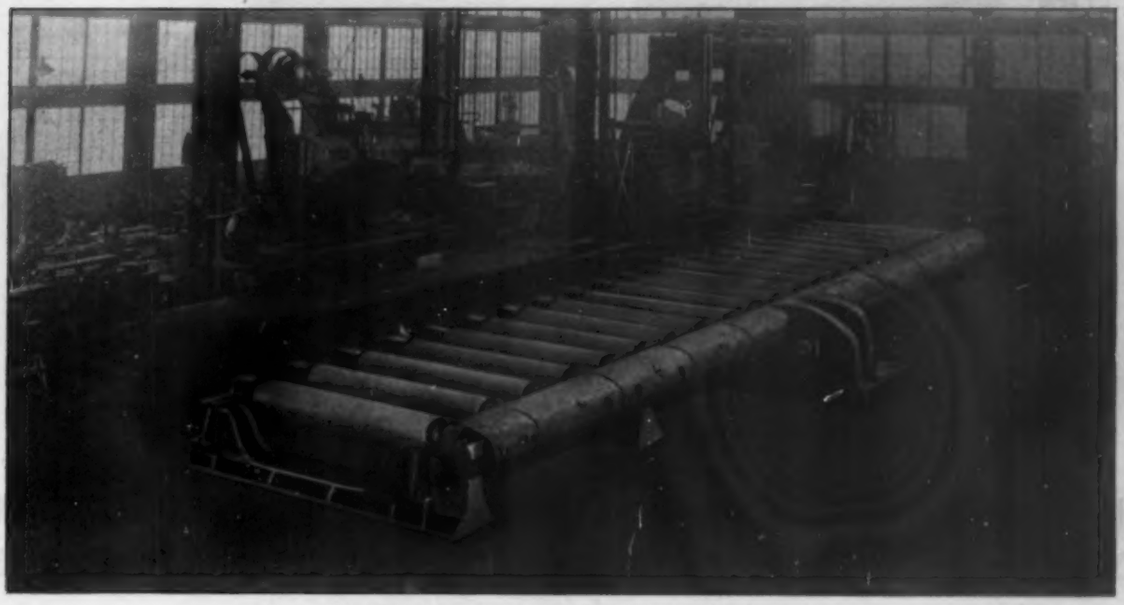
STEEL WORKS EQUIPMENT



Straightening Table for 36" x 110" Plate Mill

Treadwell Means Service not only in the fulfillment of specifications, but also in the sense of assisting you to produce efficiently and economically.

We are prepared to design and build all kinds of Rolling Mill and Steel Works Equipment.

We specialize on Mill Tables, Crop Conveyors, Shears, Ingot and Charging Box Cars.

TREADWELL ENGINEERING COMPANY

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NEW YORK PHILADELPHIA CHICAGO

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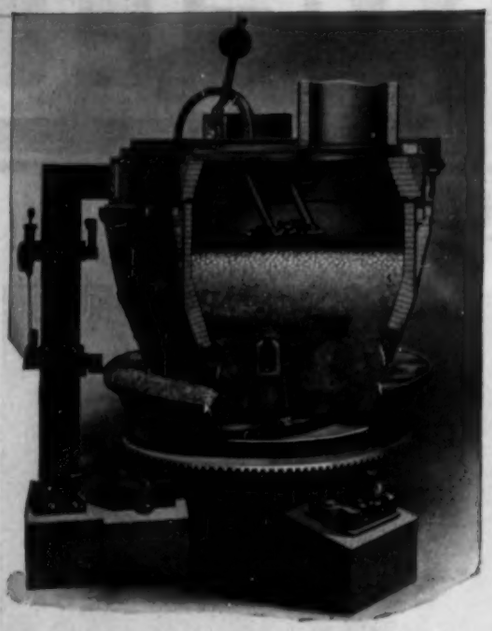

Have you seen those remarkable continuous records made by the

Morgan Producer-Gas Machine?

Nothing like them before. They place this machine in a class entirely beyond the reach of the ordinary mechanical gas producer.

Capacity, Gas Quality, Freedom from Labor and Economy of Installation are all increased to a surprising degree

See new Catalogue by the

Morgan Construction Company
Worcester, Mass.

WHEELING MOLD & FOUNDRY CO.
WHEELING, W. VA.

Rolling Mill Machinery
Steel Castings
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Special Machinery

High Grade
Prompt Delivery

Steel Rolls
Super-Steel Rolls
Chilled Rolls
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50-Ton O. H. Furnace

Steel Plant Construction
Open Hearth and Heating Furnaces
Stacks and Gas Mains
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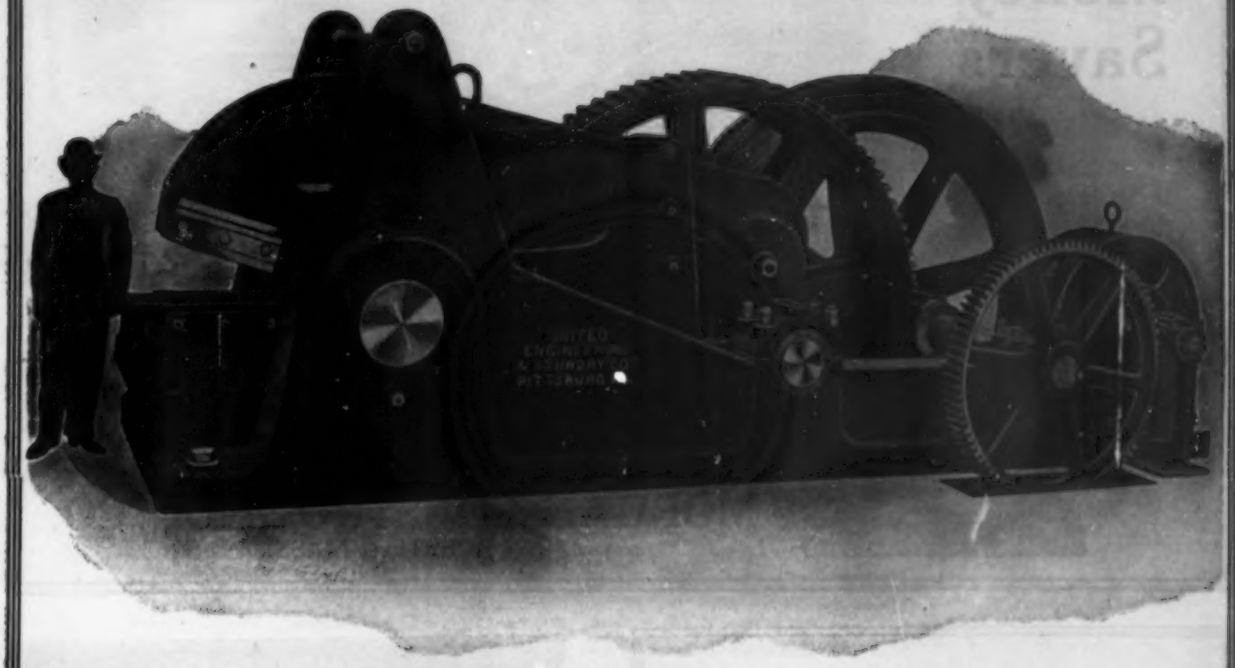
Steel Structural and Plate Work

W. W. LINDSAY & CO.
2 South 15th St., PHILADELPHIA

THE MOST POWERFUL LEVER SHEAR EVER BUILT



Capacity 6½" x 6½" Cold Soft Steel

Knife 36" long with 4 cutting edges

Speed 4 cuts per minute

The wide range of work these shears can handle, little necessity of attention and simplicity of construction, are important factors when general merchant mill or scrap-yard work is to be done.

United Engineering & Foundry Co. shears contain many new features essential to modern machines.

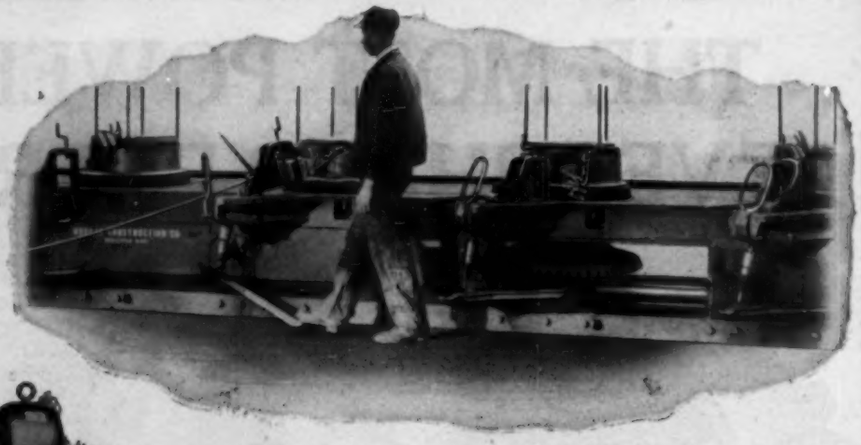
UNITED ENGINEERING & FOUNDRY CO.

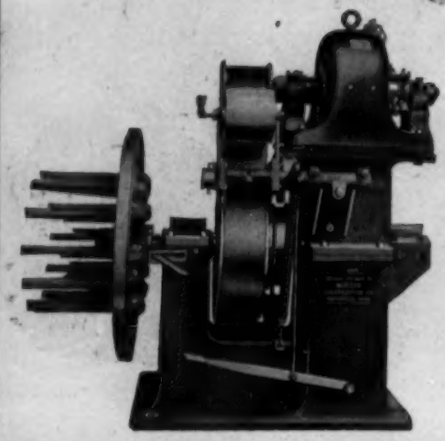
PITTSBURGH, PA.

Builders of Complete Machinery Equipment for Iron, Steel and Tube Works; Steel Castings; Machine Molded Gears, Forging Presses; Steel, Sand, Chilled and "Adamite" Rolls

"Largest Roll Makers in the World, Makers of the Largest Rolls"

A line of big Money Savers





Rod Frame equipped with Carroll Friction Blocks

MILL EQUIPMENT

The above illustration shows one of our heavy rod frames equipped with ***Friction Blocks.*** Enclosed within each block is a coil clutch. We equip each block with an automatic safety stop.

No draw-out mechanism is required, and the machine is characterized by high efficiency and low maintenance costs.

We also design and build MILLS for ***Billets, Bars, Thin Flats*** and ***Rods.*** Also Heating Furnaces, Cooling Beds, Dyblie Gas and Air Reversing Valves. ***Write us for full details.***

MORGAN CONSTRUCTION CO.
WORCESTER, MASS.

Early Delivery

BULLARD

Cartridge Case Finishing Machines

3 in., 4 in., 4.7 in., 5 in. and 6 in.
Army and Navy Ammunition

The Bullard Machine Tool Co.
Bridgeport, Conn., U. S. A.

NEW BRITAIN SHOP SHELVING

Constructed wholly of iron and steel, comprising a system of units of various dimensions which may be expanded or contracted to meet any requirements.

Clean — Handsome — Strong

No wood to splinter and Become Oil Soaked—Fire Proof.

No Obstruction to the Light, Everything in Plain Sight.

Ideal for storing parts in machine, stock, or assembling rooms. Also for jigs, dies, and special tools in tool room.

Send for Bulletin No. 1221.

THE NEW BRITAIN MACHINE CO.
Shop Furniture Originators
New Britain, Conn.

WHAT MAKES A GOOD ABRASIVE DISC

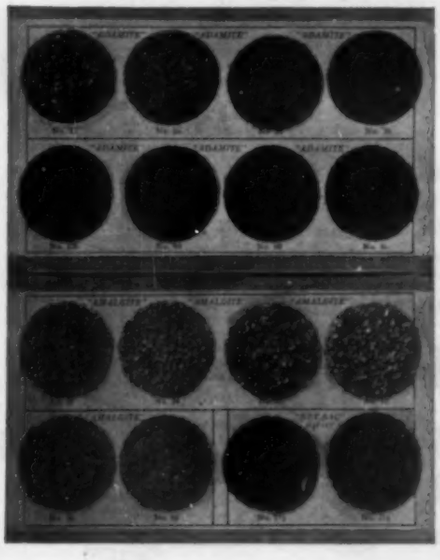
Enlarged Section of Gardner Abrasive Disc

IF you operate any kind of a disc grinding machine in your plant it will be to your advantage to acquire all the information given on this page. It never pays to use an abrasive disc simply because it is cheap. You should learn how a disc is made, study its make-up and measure the results it gives. The purchasing and use of abrasive discs present a greater opportunity for effecting savings or incurring wastes than any other line of supplies used by the trade. Here are the main essentials of a Gardner Abrasive Disc:

(1) GRAINS, ABRASIVE. (a) They are carefully selected according to the metal to be ground; (b) they are accurately screened to size; (c) they are free from dust and other impurities frequently present with this material; (d) they are sharp and possess the necessary fracture qualities; (e) Gardner discs carry the maximum amount of grains practicable.

(2) BOND, GLUE. (a) We use a glue specially prepared for abrasive disc service; (b) it is brittle yet elastic enough to release dulled grains, thereby exposing new cutting points; (c) a large amount of glue is used but not enough to interfere with the cool, free cutting action of the disc; (d) Gardner discs can be kept in proper storage an unusually long period of time without bond deterioration.

(3) BACKING, CLOTH. (a) The cloth used in Gardner discs is an especially heavy and tough drill; (b) it is uniform in thickness and free from wrinkles or uneven spots; (c) the edges are trimmed smoothly and closely to size for diameter and center hole; (d) the grain number, kind of material and lot number is printed on the cloth back of every disc. By this means the consumer knows exactly what he is using and we are enabled to keep a close record of every disc we send out.



Samples of This Material—Free

As consumer of abrasive discs you should have in your files a free copy of our "No. 16 Abrasive Disc Folder." It contains 14 actual samples of the famous "Adamite" and "Amalgite" material; also, two samples of "Net-bac" Garnet Paper used on Pattern-makers' disc grinders. In addition to showing samples of abrasive material, this book tells how to properly reface steel disc wheels, what to do when grinding aluminum and soft metals and gives other information of benefit to all users of disc grinding machines.

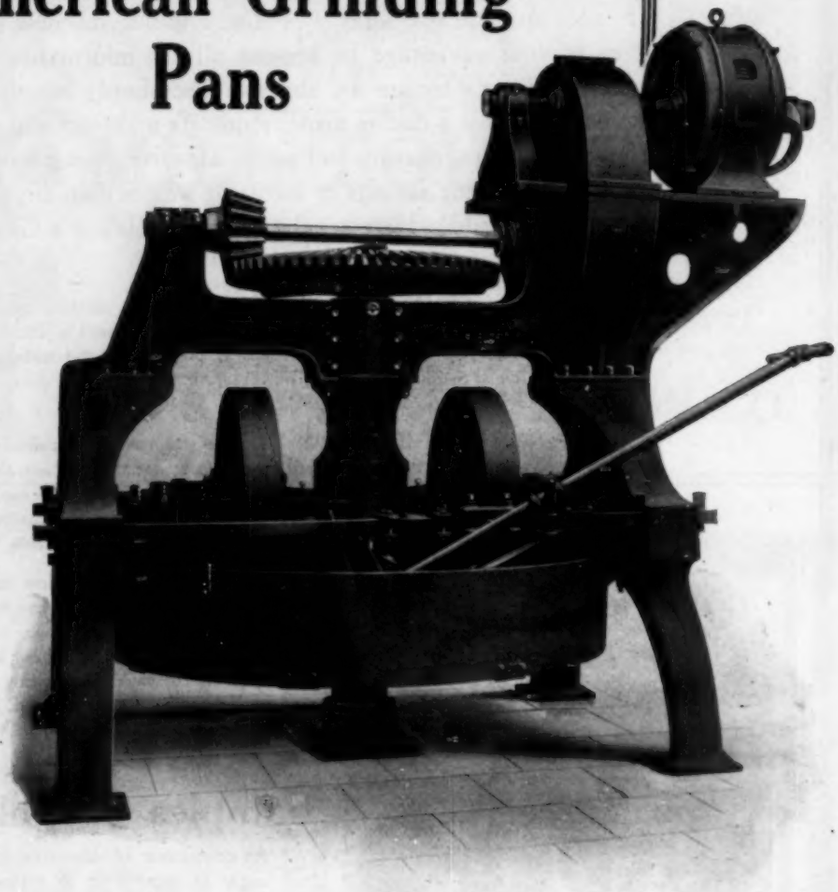
Gardner abrasive discs are manufactured for us by Herman Behr & Co., Inc., New York City, who have been making abrasive cloth and paper goods for the past 60 years. Combined with this fact is our intimate knowledge of modern disc grinding requirements. We know what is needed—they know how to make it. Gardner Abrasive Discs not only give maximum service but entitle you to unlimited co-operation from "The Disc Grinding Authorities."

Gardner Machine Co.

BELOIT, WISCONSIN, U. S. A.

Built right—run right

American Grinding Pans



Built by a company that is backed by over 60 years' successful experience in this particular line.

American Grinding Pans are the accepted standard of the largest Steel Plants and Foundries of our country.

Used in Steel Plants for grinding ganister and flue dust—in Foundries for reclaiming core sand, mixing core sand and preparing facings.

Write for our latest bulletin

American Clay Machinery Company

BUCYRUS, OHIO

The Planing Tool has a serrated ring of improved steel which affords unequaled variety and rapidity of adjustment. The ring is correctly hardened to resist the wear of the cutter.

The body of the holder receives a very different heat treatment that prevents breakage.

The Way We All Use Machine Tools

May Win or Lose the War!

Why not profit by the late experience and example of other nations and adopt tool holder economies now?

Cut out machine idleness due to shaping, sharpening and needless shifting of forged tools. Keep many machines working full time with the same tool steel and less labor than solid tools require to keep one machine busy on part time.

The Boring Tool takes any size or shape of bar and requires no bushings. Its sleeve bar cap admits a straight or angular cutter; either can be quickly inserted at the business end of the bar without removing the cap or disturbing the setting of either the bar or the holder.

The Threading Tool with lockable spring head will do roughing, finishing and threading at one setting in the tool post.

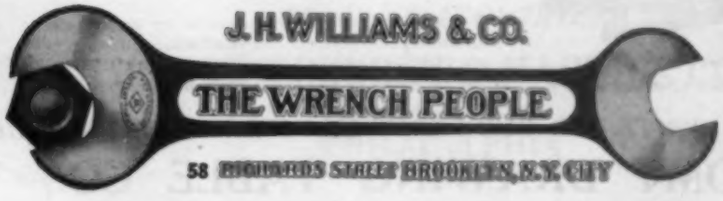
Williams' "AGRIPPA" Tool Holders

"THE HOLDERS THAT HOLD"

save the most time and need the least shifting.

We will ship them promptly if your dealer can't supply you from stock.

A tool that performs both cutting off and side work by the mere substitution of suitable cutters tells its own story of economy.



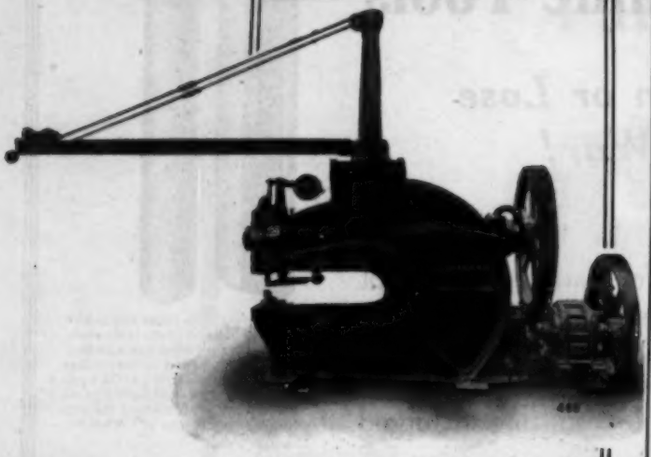
"Toledo" No. 208½, 60 tons, 4550 to 450,000 lbs.

The "TOLEDO" Patented Double Crank Toggle Drawing Presses

The most successful Press on the market for use in the manufacture of automobile bodies, crown fenders, hoods, radiators, cowls, engine pans, front seats, rear tonneaus, and for various deep stamping and forming operations.

The patented toggle movement exerts a 90° dwell of blank holder. Its action is smooth and noiseless and affords greatest safety for operator. The several parts are massive and capable of operating dies for the heaviest work.

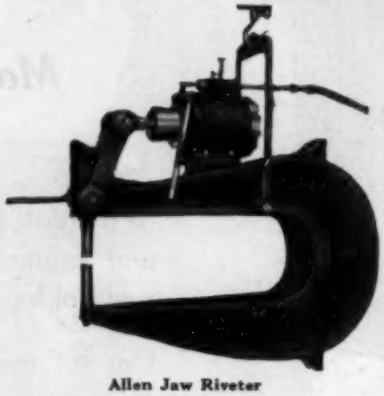
The Toledo Machine & Tool Co., Toledo, Ohio



The Cleveland Punch & Shear Works Co.

Cleveland, O.

"CLEVELAND" Punches are known everywhere for their efficiency, accurateness and durability. Made of the best materials, by experienced, high grade workmen, we guarantee them to fulfill every requirement for such equipment. Send for catalog illustrating and describing in detail the "Cleveland" line of punches.



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For 45 Years

ALLEN

Portable Pneumatic

RIVETING MACHINES

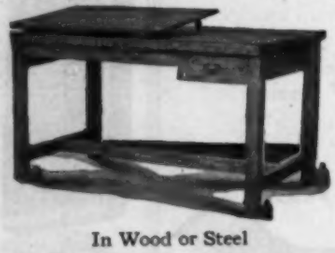
have set an exceptionally high standard for mechanical excellence and service performance.

They Still Lead!

Entire line fully illustrated and described in new catalog just issued. Send for it.

JOHN F. ALLEN CO.

372 Gerard Avenue NEW YORK



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From Factory to customer

ECONOMIZE

by getting up SPEED in the DRAFTING ROOM through the use of ECONOMY DRAWING TABLES

Tables and filing cases planned by an engineer who knows the needs of the draftsman.

SIXTEEN YEARS' EXPERIENCE IN BUILDING.

We can prove to you how a draftsman's output can be increased.

WRITE FOR OUR LARGE ILLUSTRATED CATALOGUE TODAY

ECONOMY DRAWING TABLE CO., Toledo, Ohio

A Combination of Rigidity, Accuracy, Simplicity and Ease of Operation

Bodies are inclinable and convenient for handling dies and material.

Slides are long and well gibbed.

BLISS

INCLINABLE Power Presses

These presses will reduce maintenance costs of both your machine and tools.

Built in eighteen sizes. Adapted for many operations in the manufacture of tin cans, pieced tinware, metal packages, brass goods, electrical goods, trimmings, etc.

Catalog 2-R describing these machines fully will be sent on request.

Talk to Us About Presses for Any and Every Purpose

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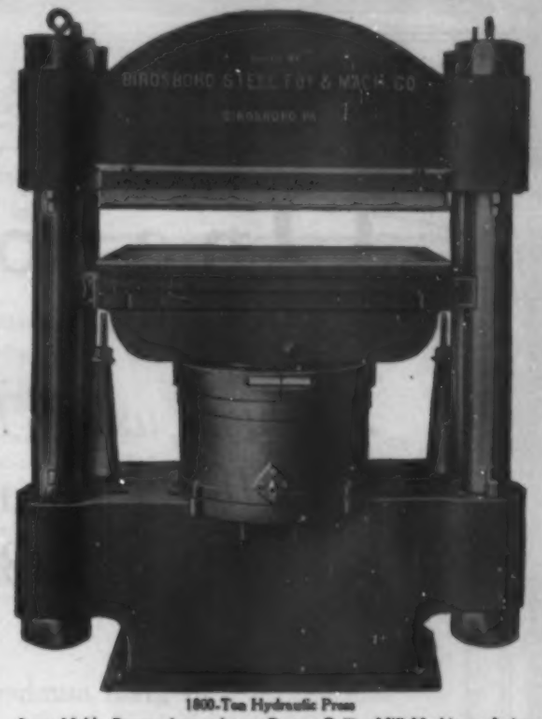

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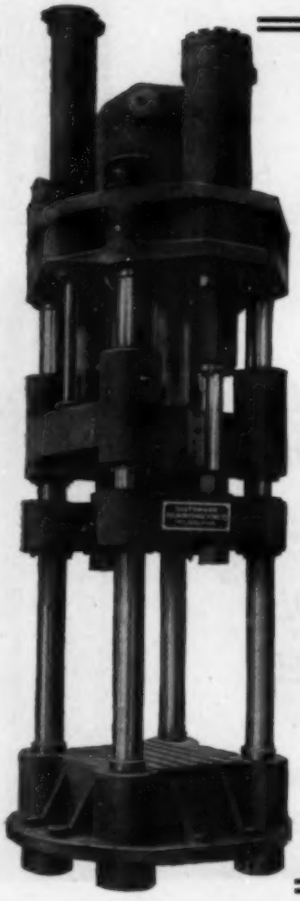

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CLEVELAND, OHIO, JUNE 28, 1917

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A weekly publication devoted to the Iron, Steel, Machinery and Foundry Industries of the United States and Canada.

Published Every Thursday by THE PENTON PUBLISHING Co., Cleveland.

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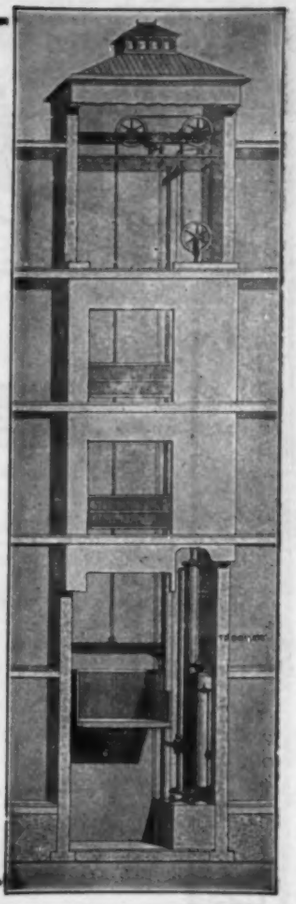

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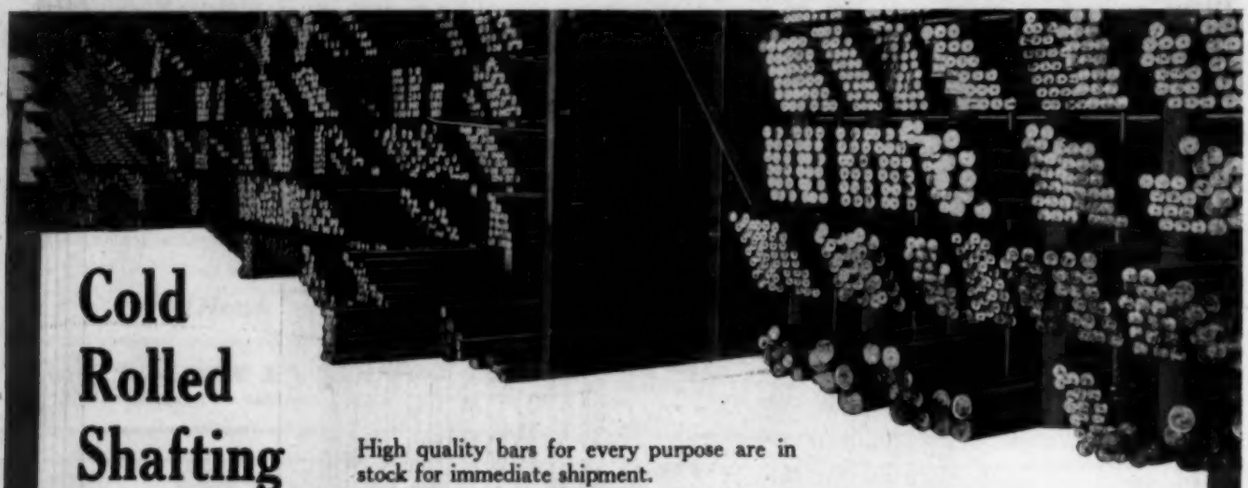

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Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

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Andrews Steel Co., Newport, Ky.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Buckeye Steel Castings Co., The, Columbus, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Federal Export Corporation, New York City.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Mudge, Edmund W., & Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wickwire Steel Co., Buffalo, N. Y.
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Youngstown Sheet & Tube Co., Youngstown.

BINS (Steel).
Empire Art Metal Co., College Pt., N. Y.

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Treadwell Engineering Co., Easton, Pa.

BLAST FURNACE SKIP CARS.
Lakewood Engrg. Co., Cleveland, O.

BLAST FURNACE TUYERES.
Keystone Bronze Co., Pittsburgh, Pa.

BLAST FURNACE VOLUME METERS.
Clark, Chas. J., Chicago, Ill.

BLOCKS (Chain).
Yale & Towne Mfg. Co., New York City.

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Andrews Steel Company, Newport, Ky.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Buckeye Steel Castings Co., The, Columbus, O.
Carnegie Steel Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
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Lackawanna Steel Co., Buffalo, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
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Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

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Connersville Blower Co., The, Connersville, Ind.
General Electric Co., Schenectady, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Roots, P. H., & F. M. Co., Connersville, Ind.
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National Machinery Co., Tiffin, O.
Newton Mach. Tool Works, Inc., Philadelphia.

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Bethlehem Steel Co., The, So. Bethlehem, Pa.

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Beals & Co., Buffalo, N. Y.
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Lockhart Iron & Steel Co., Pittsburgh, Pa.
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National Bolt & Nut Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Rockford Bolt Co., Rockford, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Il.
St. Louis Screw Co., St. Louis, Mo.
Upson Nut Co., Cleveland, O.

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Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

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Blackwood Steel Fdy. Co., The, Springfield, O.

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Acme Steel Goods Co., Chicago, Ill.

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Electric Controller & Mfg. Co., Cleveland, O.
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Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

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Gardner, B. M., Co., Cleveland, O.

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McKenna Brothers, Pittsburgh, Pa.

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Prest-O-Lite Co., The, Indianapolis, Ind.

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American Refractories Co., Chicago, Ill.
Kier Fire Brick Co., Pittsburgh, Pa.
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Union Mining Co., Mount Savage, Md.

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BRICKMAKING MACHINERY.
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Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Chesapeake Iron Works, Baltimore, Md.
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Lindsay, W. W., Co., Philadelphia, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
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Dixon, Jos., Crucible Co., Jersey City, N. J.

BRONZE (Manganese).
Bethlehem Steel Co., The, So. Bethlehem, Pa.

BUCKETS (Clam Shell).
Hayward Company, The, New York City.
Lakewood Engrg. Co., Cleveland, O.

BUCKETS (Drag Line).
Hayward Company, The, New York City.

BUCKETS (Dumping).
Atlas Car & Mfg. Co., The, Cleveland, O.

BUCKETS (For All Purposes).
Blaw Steel Construction Co., Pittsburgh, Pa.

BUCKETS (Grab).
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Brown Hoisting Machy. Co., Cleveland, O.
Hayward Company, The, New York City.
Industrial Works, Bay City, Mich.
Lakewood Engrg. Co., Cleveland, O.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.

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Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BULLDOZERS.
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CANS (Waste, Shop and Oil).
New Britain Mach. Co., New Britain, Conn.

CAR BOLSTERS.
Buckeye Steel Castings Co., The, Columbus, O.

CARBONIZING BOXES.
Blackwood Steel Fdy. Co., The, Springfield, O.

CARS (Industrial).
Treadwell Engineering Co., Easton, Pa.

CARS (Industrial and Mining).
American Bridge Co., New York, N. Y.
American Steel Export Co., New York City.
Atlas Car & Mfg. Co., The, Cleveland, O.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Chase Fdy. & Mfg. Co., Columbus, O.
Federal Export Corporation, New York City.
Lakewood Engrg. Co., Cleveland, O.
Lindsay, W. W., Co., Philadelphia, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS (Steel).
Cambria Steel Co., Philadelphia, Pa.

CAR TRUCK FRAMES.
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IRON CASTINGS of all Descriptions.

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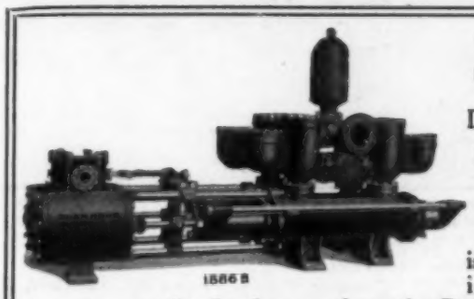

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DEAN BROS. STEAM PUMP WORKS. **INDIANAPOLIS.**

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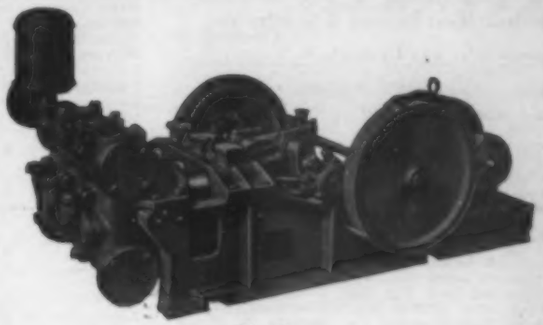

Fig. 72

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DEMING PUMPS

Cover practically all the pumping requirements of the mine, mill and factory. They are made in many different styles and sizes. Capacities from 300 gallons to 132,000 gallons per hour in standard sizes.

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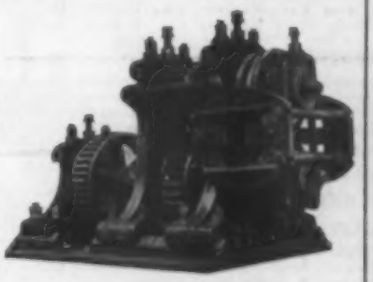
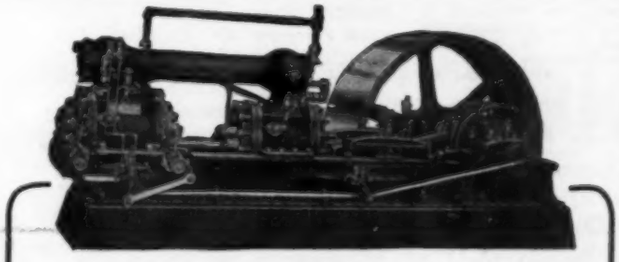
Rolling Mill Equipment
Rolls (sand and chilled)
Pipe Threading Machinery
Castings—gray iron, semi-steel, cupola, and air furnace
Machine work to drawings



Sizing Machine for Lap Welded Pipe



Automatic Selective Proportional Unloaders are found exclusively on the

NORWALK COMPRESSOR These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers.

For the usual hackneyed claims of **ECONOMY, DURABILITY** and **EFFICIENCY**, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

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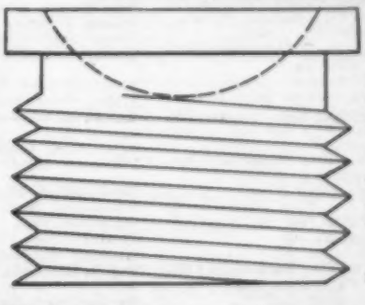
Hardwood Base Plugs

made to your specifications.



Slotted-threaded and boiled in paraffine.

Our base plugs have been accepted as standard.

BOGERT & HOPPER

45 Barclay St., New York

CASE HARDENING.

Bidle, W. S., Co., Cleveland, O.
Cleveland Metal Treating & Welding Co., Cleveland, O.
Roberts Mfg. Co., Lockport, N. Y.

CASE HARDENING BOXES.

Blackwood Steel Fdy. Co., The, Springfield, O.

CASTINGS (Air Furnace).

Buffalo Foundry & Mach. Co., Buffalo, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

CASTINGS (Alloy Steel).

American Vanadium Co., Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Blackwood Steel Fdy. Co., The, Springfield, O.
Sivyer Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

CASTINGS (Brass, Bronze and Aluminum).

Acieral Co. of America, Newark, N. J.
Brass Foundry Co., Peoria, Ill.
Dake Engine Co., Grand Haven, Mich.
Electrical Specialties Mfg. Co., Benton Harbor, Mich.
Evinrude Motor Co., Milwaukee, Wis.
Keystone Bronze Co., Pittsburgh, Pa.
Klotz Machine Co., Sandusky, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS (Chilled).

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
McLain's System, Inc., Milwaukee, Wis.

CASTINGS (Converter Steel).

Reading Steel Casting Co., Reading, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Smith, Geo. H., Steel Casting Co., Milwaukee.

CASTINGS (Crucible Steel).

Sivyer Steel Casting Co., Milwaukee, Wis.

CASTINGS (Die).

Lubricating Metal Co., The, New York City.
Ohmer Fare Register Co., Dayton, O.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS (Electric Furnace).

Latrobe Electric Steel Co., Latrobe, Pa.
Racine Steel Castings Co., Racine, Wis.
Sivyer Steel Castings Co., Milwaukee, Wis.
Treadwell Engrg. Co., Easton, Pa.
United Alloys Steel Corp., The, Canton, O.

CASTINGS (Furnace).

Marshall Foundry Co., Pittsburgh, Pa.

CASTINGS (Gear).

Allyne-Ryan Foundry Co., Cleveland, O.
Dayton Steel Foundry Co., Dayton, O.
Link-Belt Company, Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Standard Steel Castings Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS (Gray Iron).

Acieral Co. of America, Newark, N. J.
Adamson Machine Co., Akron, O.
American Bridge Co., New York, N. Y.
Arcade Mfg. Co., Freeport, Ill.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Caldwell & Drake Iron Works, Inc., Columbus, Ind.
Cascade Foundry Co., Erie, Pa.
Cyclops Foundry Co., Pittsburgh, Pa.
Dake Engine Co., Grand Haven, Mich.
Davis, Charles E., Rutland, Vt.
Erie Foundry Co., Erie, Pa.
Etna Machine Co., Toledo, O.
Farrel Foundry & Mach. Co., Ansonia, Conn.
Hill, Wm. E., Co., Kalamazoo, Mich.
Hopes Combustion Engineering Corp., Glen Falls, N. Y.
Ironton Engine Co., Ironton, O.
Klotz Machine Co., Sandusky, O.
Link-Belt Company, Chicago, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Marshall Foundry Co., Pittsburgh, Pa.
Metals Production Equipment Co., Springfield, Mass.
Morgan Engineering Co., Alliance, O.
Murray Iron Works Co., Burlington, Iowa.
Nagle-Corliss Engine Co., Erie, Pa.
National Foundry Co., Erie, Pa.
North Buffalo Hdwe. Fdy. Co., Buffalo, N. Y.
Phoenix Iron Works Co., Meadville, Pa.
Poorman, O. O., Co., New Bremen, O.
Scranton Fdy. & Engine Works, New York.
Simpson Foundry Co., Newark, O.
Standard Engrg. Co., Ellwood City, Pa.
Standard Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Wheeling Mold & Foundry Co., Pittsburgh.
Williamson, J. E., Co., Bellwood, Pa.
Youngstown Sh't & Tube Co. Youngstown, O.

CASTINGS (Malleable).

Acme Steel & Malleable Iron Works, Inc., Buffalo, N. Y.
Belle City Malleable Iron Co., Racine, Wis.
Columbus Malleable Iron Co., Columbus, O.
Danville Malleable Iron Co., Danville, Ill.
Dayton Malleable Iron Co., Dayton, O.
Decatur Malleable Iron Co., Decatur, Ill.
Erie Malleable Iron Co., Erie, Pa.
Fanner Mfg. Co., Cleveland, O.
Frazer & Jones Co., Syracuse, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Lakeside Malleable Castings Co., Racine, Wis.
Link-Belt Company, Chicago, Ill.
Mal-Gra Castings Co., Cambridge City, Ind.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., E. St. Louis, Ill.
Moline Malleable Iron Co., St. Charles, Ill.
National Malleable Castings Co., Cleveland, O.
Northwestern Malleable Iron Co., Milwaukee, Wis.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Standard Malleable Iron Co., Muskegon, Mich.
Wisconsin Malleable Iron Co., Milwaukee, Wis.
Zanesville Malleable Iron Co., Zanesville, O.

CASTINGS (Open Hearth).

Atlas Steel Casting Co., Buffalo, N. Y.

CASTINGS (Semi-Steel).

Adamson Machine Co., Akron, O.
Allyne-Ryan Fdy. Co., Cleveland, O.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Cincinnati Steel Castings Co., Cincinnati, O.
Morgan Engineering Co., Alliance, O.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS (Steel).

Adamson Machine Co., Akron, O.
American Bridge Co., New York City.
American Steel Foundries, Chicago, Ill.
Atlas Steel Casting Co., Buffalo, N. Y.
Bayonne Steel Casting Co., Bayonne, N. J.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Blackwood Steel Fdy. Co., The, Springfield, O.
Burnside Steel Co., Chicago.
Cincinnati Steel Castings Co., Cincinnati, O.
Connecticut Electric Steel Co., Inc., Hartford, Conn.
Dayton Steel Foundry, Dayton, O.
Farrell-Cheek Steel Foundry Co., Sandusky, O.
Federal Steel Foundry Co., Chester, Pa.
Hubbard Steel Foundry Co., E. Chicago, Ind.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McCord & Co., Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Midvale Steel Co., Philadelphia, Pa.
Morgan Engineering Co., Alliance, O.
National Foundry Co., Erie, Pa.
National Malleable Castings Co., Cleveland, O.
National Roll & Foundry Co., Avonmore, Pa.
Otis Steel Co., Cleveland, O.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Reading Steel Casting Co., Reading, Pa.
Reliance Steel Casting Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Sharon Foundry Co., Sharon, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Standard Steel Castings Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
West Steel Casting Co., Cleveland, O.
Wheeling Mold & Foundry Co., Pittsburgh, Pa.

CASTINGS (Steel, for Electrical Apparatus).

Blackwood Steel Fdy. Co., The, Springfield, O.
Burnside Steel Co., Chicago.
Dayton Steel Foundry, Dayton, O.
National Malleable Castings Co., Cleveland, O.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
West Steel Casting Co., Cleveland, O.

CASTINGS (Stellite).

Haynes Stellite Co., The, Kokomo, Ind.

CEMENT (Fire Brick).

Botfield Specialties Co., Philadelphia.

CEMENT MACHINERY.

Vulcan Iron Works, Wilkesbarre, Pa.

CEMENT WATERPROOFING.

Texas Company, The, New York City.

CENTRAL STATION EQUIPMENT.

General Electric Co., Schenectady, N. Y.
Smith Gas Engrg. Co., The, Lexington, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CENTRIFUGAL COAL DRIERS.

Link-Belt Company, Chicago, Ill.

CHAIN.

Larkin, J. K., & Co., New York City.

CHAIN DRIVES.

Link-Belt Company, Chicago, Ill.

CHAIN MACHINERY (Coil Chain).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CHAINS.

Jones & Laughlin Steel Co., Pittsburgh, Pa.
Link-Belt Company, Chicago, Ill.

CHAINS (Conveyor).

Link-Belt Company, Chicago, Ill.

CHAINS (Power Transmitting).

Link-Belt Company, Chicago, Ill.

CHAPLETS.

Champion Mch. & Forging Co., Cleveland, O.
Fanner Mfg. Co., Cleveland, O.
Lindsay, W. W., Company, Philadelphia, Pa.

CHARCOAL.

Hillman, J. H., & Sons Co., Pittsburgh, Pa.

CHARCOAL CARS.

Lakewood Engrg. Co., Cleveland, O.

CHARGING BUGGY.

Lakewood Engrg. Co., Cleveland, O.

CHARGING MACHINES.

Morgan Engineering Co., Alliance, O.

CHECKS (Time, Tool and Pay).

Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pannier Bros. Stamp Co., Pittsburgh, Pa.

CHEMICAL APPARATUS.

Buffalo Foundry & Mach. Co., Buffalo, N. Y.

CHEMICALS.

Ford, J. B., Co., Wyandotte, Mich.

CHEMISTS AND METALLURGISTS.

Bidle Co., W. S., Cleveland, O.
Hunt, Robt. W., Co., Chicago, Ill.
Steel Improvement & Forge Co., Cleveland, O.

CHROME ORE.

Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.

CHUCKS.

Modern Tool Co., Erie, Pa.

CHUCKS (Drill).

Clark Equipment Co., Buchanan, Mich.

CHUCKS (Lathe).

Whiton, D. E., Mch. Co., New London, Conn.

CINDER MILLS (Water).

Whiting Foundry Equipment Co., Harvey, Ill.

CINDER POTS.

Marshall Foundry Co., Pittsburgh, Pa.

CIRCUIT BREAKERS.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CLAMPS ("C").

Williams, J. H., & Co., Brooklyn, N. Y.

CLAY MACHINERY.

American Clay Machinery Co., Bucyrus, O.

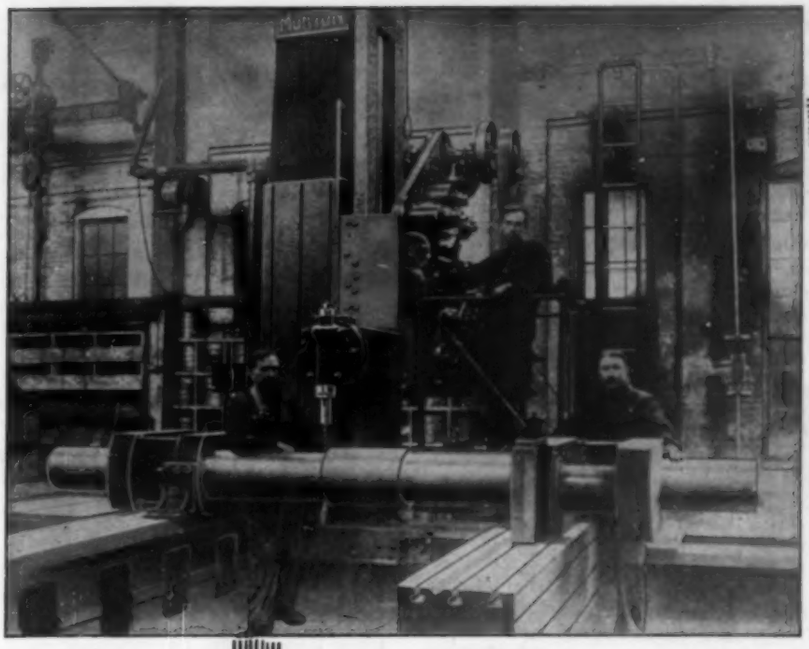
CLEANER (Metal).

Ford, J. B., Co., Wyandotte, Mich.

CLEANING SPECIALTIES.

Ford, J. B., Co., Wyandotte, Mich.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above



72-inch Stroke Traveling Head Planer, showing Vertical Boring and Milling attachment operating on double throw Crank Shaft.

You can do it with a

MORTON—

and you can do it quicker and cheaper.

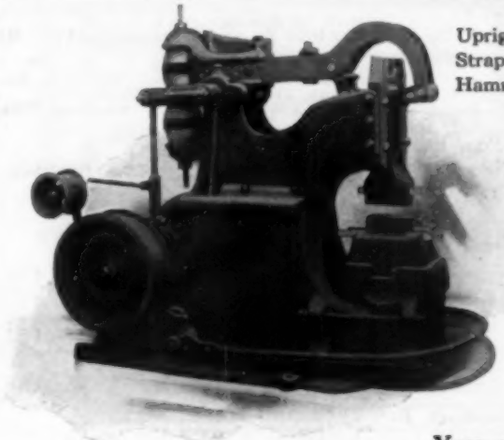
Morton Traveling Head Planers plane, face, mill and bore. They are easily changed for any operation. They cut Keyseats in shafts, and Keyways in large Hubs.

They are reversible, and may be used as Horizontal Slotters.

Morton Traveling Head Planers cannot be surpassed in efficiency or economy.

Ask us to send you our Bulletin 6-H

MORTON MANUFACTURING COMPANY
Muskegon Heights MICH., U. S. A.



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You get
Greater output with less repair expense
when you have

BRADLEY HAMMERS

Cushioned Helve Hammers
Upright Strap Hammers
Upright Helve Hammers
Compact Hammers

For Forging; Drawing; Swaging; Collaring; Welding; or Spindle Work. ¶ A Bradley Hammer for every requirement.

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Foreign Agents:—England—Buck & Hickman, Ltd., London. France, Belgium, Switzerland, Spain and Portugal—Fenwick Freres & Co., 8 Rue de Rocroy, Paris Italy—Taddeo Giusti, Modena, Italy

The Reason for so Many Repeated Orders

after comparative tests is that no magnifying glass is necessary to distinguish the increased production and the better class of work on the PEERLESS High Speed Cutting-Off Saw.

A third order just came in from one of the largest concerns in the United States, and is it not a fact after a firm has standardized on a certain tool that some real results must be produced in order to effect a change?

One of our customers writes—"It takes us only 1/15 of the time to cut our stock on the PEERLESS that it did on our other machine".

If you are open to conviction we have a proposition to offer that no manufacturer can afford to pass up.

PEERLESS MACHINE CO., Racine, Wisconsin
1605 Racine Street

CLUTCHES.

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Link-Belt Company, Chicago, Ill.

COAL.

Addy, Matthew, Co., The, Cincinnati, O.
Alden Coal Mining Co., New York City.
Baird & West, Detroit, Mich.
Bixler Coal & Coke Co., Pittsburgh, Pa.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
Mudge, Edmund W., & Co., Pittsburgh Pa.
National Fuel Co., Pittsburgh, Pa.
Reilly-Peabody Fuel Co., Pittsburgh, Pa.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., Co., Pittsburgh, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COAL CRUSHERS AND PULVERIZERS.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
Link-Belt Company, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.
Raymond Bros. Impact Pulverizer Co., The, Chicago, Ill.

COAL, ORE AND ASH HANDLING MACHINERY.

American Bridge Co., New York, N. Y.
Blaw Steel Construction Co., Pittsburgh, Pa.
Brown Hoisting Machy. Co., Cleveland, O.
Hayward Company, The, New York City.
Link-Belt Company, Chicago, Ill.
Orton & Steinbrenner Co., Chicago, Ill.

COAL TIPPLES.

Eichleay, John Jr., Co., Pittsburgh, Pa.
Link-Belt Company, Chicago, Ill.

COAL WASHERS.

Link-Belt Company, Chicago, Ill.

COILING MACHINERY.

Sleeper & Hartley, Inc., Worcester, Mass.

COILS (Pipe).

Pittsburgh Piping & Equip. Co., Pittsburgh.
Roessing-Ernst Co., Etna, Pittsburgh, Pa.

COKE.

Addy, Matthew, Co., The, Cincinnati, O.
Alden Coal Mining Co., New York City.
Baird & West, Detroit, Mich.
Bixler Coal & Coke Co., Pittsburgh, Pa.
Bourne-Fuller Co., Cleveland, O.
Crocker Bros., New York City.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
McKeefrey & Co., Leetonia, O.
Mohr, J. J., & Son, Philadelphia, Pa.
Mudge, Edmund W., & Co., Pittsburgh, Pa.
National Fuel Co., Pittsburgh, Pa.
Reilly-Peabody Fuel Co., Pittsburgh, Pa.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Tennessee Coal, Iron & R. R. Co. Birmingham, Ala.
Washington Coal & Coke Co., Dawson, Pa.

COKE OVENS (By-Product).

Koppers, H., Co., Pittsburgh, Pa.

COMPRESSORS (Air).

Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Norwalk Iron Works Co., So. Norwalk, Conn.
Southwark Foundry & Machine Co., Philadelphia
Standard Scale & Supply Co., Pittsburgh, Pa.
Wickes Brothers, Saginaw, Mich.

COMPRESSORS (Gas).

Norwalk Iron Works Co., So. Norwalk, Conn.

CONCRETE CONSTRUCTION.

Blystone Mfg. Co., Cambridge Springs, Pa.

CONCRETE INSERTS.

Dayton Malleable Iron Co., Dayton, O.

CONCRETE MIXERS.

Blystone Mfg. Co., Cambridge Springs, Pa.
Lakewood Engrg. Co., Cleveland, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

CONCRETE REINFORCEMENT.

American Steel & Wire Co., Chicago, Ill.

CONDENSERS.

Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Cooper, C. & G., Mt. Vernon, O.
Dean Bros. Steam Pump Works, Indianapolis.
Mesta Machine Co., Pittsburgh, Pa.

CONDUCTORS (Armored Electric).

Youngstown Sheet & Tube Co., Youngstown, O.

CONDUITS (Electrical).

Youngstown Sheet & Tube Co., Youngstown, O.

CONSTRUCTION (Buildings and Furnaces).

Eichleay, John Jr., Co., Pittsburgh, Pa.
Lindsay, W. W., Co., Philadelphia, Pa.

CONTRACTORS (See Engineers and Contractors).

CONTRACTORS EQUIPMENT.

Lakewood Engrg. Co., Cleveland, O.
Mitshkum Co., M., Detroit, Mich.

CONTROLLERS (Electric).

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Morgan Engineering Co., Alliance, O.
Toledo Bridge & Crane Co., Toledo, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS (Bessemer).

Pennsylvania Engineering Works, New Castle, Pa.

CONVERTERS (High Speed Steel).

Onondaga Steel Co., Syracuse, N. Y.

CONVERTERS (Steel Castings).

Whiting Foundry Equipment Co., Harvey, Ill.

CONVEYORS (Elevating and Conveying).

Brown Hoisting Machinery Co., Cleveland, O.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Roots, P. H., & F. M., Co., Connersville, Ind.
Vulcan Iron Works, Wilkesbarre, Pa.
Wellman-Seaver-Morgan Co., Cleveland.

COOLING BEDS.

Treadwell Engineering Co., Easton, Pa.

CORE MAKING MACHINES.

Pridmore, Henry E., Chicago, Ill.

CORE OVENS.

Metals Production Equipment Co., Springfield, Mass.
Whiting Fdy. Equipment Co., Harvey, Ill.

CORE OVEN CARS.

Lakewood Engrg. Co., Cleveland, O.

CORRUGATED FASTENERS.

Acme Steel Goods Co., Chicago, Ill.

COUNTERSHAFTS.

Kempsmith Mfg. Co., Milwaukee, Wis.

COUNTING MACHINES.

Hart, R. A., Mfg. Co., Battle Creek, Mich.

COUPLING BOXES.

Pittsburgh Iron & Steel Foundries, Pittsburgh, Pa.

COUPLINGS.

American Vanadium Co., The, Pittsburgh, Pa.
Connersville Blower Co., The, Connersville, Ind.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.
Roots, P. H., & F. M., Co., Connersville, Ind.

COUPLINGS (Carriage).

Bradley, C. C., & Son, Inc., Syracuse, N. Y.

CRANES (Charging).

Alliance Machine Co., Alliance, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Pawling & Harnischfeger Co., Milwaukee, Wis.

CRANES (Electric).

Alliance Machine Co., Alliance, O.
Biggs-Watterson Co., The, Cleveland, O.
Brown Hoisting Machinery Co., Cleveland, O.
Browning Co., The, Cleveland, O.
Case Crane & Engrg. Co., The, Columbus, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Euclid Crane & Hoist Co., Euclid, O.
Industrial Works, Bay City, Mich.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Ridgway, Craig & Son, Coatesville, Pa.
Shaw Electric Crane Co., New York, N. Y.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.

CRANES (Hand).

Brown Hoisting Machinery Co., Cleveland, O.
Case Crane & Engrg. Co., The, Columbus, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Euclid Crane & Hoist Co., Euclid, O.
Link-Belt Company, Chicago, Ill.
Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
Toledo Bridge & Crane Co., Toledo, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York City.

CRANES (Hydraulic).

Alliance Machine Co., Alliance, O.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Morgan Engineering Co., Alliance, O.
Ridgway, Craig, & Son, Coatesville, Pa.
Southwark Foundry & Machine Co., Philadelphia
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CRANES (Locomotive).

Brown Hoisting Machinery Co., Cleveland, O
Browning Co., The, Cleveland, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Industrial Works, Bay City, Mich.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Niles-Bement-Pond Co., New York City, N. Y.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis
Wellman-Seaver-Morgan Co., Cleveland.

CRANES (Steam Cleaning House).

Cleveland Crane & Engrg. Co., Wickliffe, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CRANES Steam and Pneumatic, Wire Mills).

Cleveland Crane & Engrg. Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CRANK SHAFTS.

Bay City Forge Co., Erie, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.

CRAYONS.

Talc Products Co., New York City.

CREDITS.

Iron & Steel Board of Trade, N. Y. City.

CRUCIBLES.

Dixon, Jos., Crucible Co., Jersey City, N. J.

CRUSHER JAWS AND ROLLS.

Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

CRUSHING MACHINERY.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
Link-Belt Company, Chicago, Ill.
Vulcan Iron Works, Wilkesbarre, Pa.

CUPOLA BLOCKS.

Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.
Wagner Fire Brick Co., Scranton, Pa.

CUPOLA, FURNACE AND FORGE LINING See Linings (Cupola, Furnace and Forge).

CUPOLA PRACTICE.

McLain's System, Inc., Milwaukee, Wis.

CUPOLAS.

Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

CUPRO-VANADIUM.

American Vanadium Co., Pittsburgh, Pa.

CUPS (Oil, Grease, Etc.).

National Malleable Castings Co., Cleveland, O.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

The Whiting Class "A" Tumbler

1700

Single Class "A" Tumbler with Pulley Drive

is a simple, durable design developed after years of study and experiment.

Heavy steel plate barrel and liner plates and castings of ample section give the strength required to stand the constant hard knocks of mill room service. Door cut from solid.

Interchangeable parts and removable trunnions cut maintenance cost to a minimum.

Low standards allow loading from either side.

We equip cleaning rooms complete.

Write for catalog No. 120

COMPLETE FOUNDRY PLANTS

DESIGNED, EQUIPPED AND PUT INTO OPERATION

CRANES OF ALL KINDS

WHITING
FOUNDRY EQUIPMENT CO.
HARVEY-ILL. U. S. A.
CHICAGO SUBURB

Roller
Bearing Cars.
Trucks for all purposes and
Complete Industrial Railway Equipments

Write for Catalog and Prices

THE CHASE FOUNDRY & MFG. CO., Columbus, O.

The largest and heaviest presses in the world are at your service for making

Sheet Metal Stampings

We can cold press, form and draw metals up to 13/16″ thick. Our prices are right and our work is guaranteed. Let us know your requirements.

The Bossert Corp., Utica, N. Y.

Black Diamond File Works

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Twelve Medals Awarded for "Very Superior Goods" at International Exhibitions

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Owned and Operated by Nicholson File Co.

At work in a
New York Subway Cave-in

The illustration shows a K-G outfit at work in one of the subway cave-ins in New York.

Operator has just cut beam in foreground and is now salving the large pipe, running lead out of the joints, thus saving the pipe intact.

The above is a very good example of one of the many uses for a K-G outfit. Under all conditions it is a guarantee of swift, efficient and economical operation.

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Morton Mfg. Co., Muskegon Heights, Mich.

CUTTERS (Stellite).
Haynes Stellite Co., The, Kokomo, Ind.

CUTTERS, LINK (Coil Chain).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

CUTTING AND WELDING (Oxy-Acetylene Process).
K. & G. Welding & Cutting Co., New York.
Linde Air Products Co., New York.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

CUTTING AND WELDING APPARATUS (Electric).
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CUTTING OFF MACHINES.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Etna Machine Co., Toledo, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Peerless Machine Co., Racine, Wis.
Q. M. S. Company, The, Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

CYANIDE HARDENING COMPOUND.
Park Chemical Co., Detroit, Mich.

CYANIDE POTS.
Blackwood Steel Fdy. Co., The, Springfield, O.
Crucible Steel Forge Co., Cleveland, O.

CYLINDERS.
National Tube Co., Pittsburgh, Pa.

DELIVERY TRUCKS.
Federal Motor Truck Co., Detroit, Mich.

DERRICKS AND FITTINGS.
American Bridge Co., New York, N. Y.
Dake Engine Co., Grand Haven, Mich.
Hayward Company, The, New York City.

DIE BLOCKS.
Heppenstall Forge & Knife Co, Pittsburgh, Pa.
McInnes Steel Co., Corry, Pa.

DIES
American Vanadium Co., The, Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Jones & Lamson Mch. Co., Springfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Lansing Stamping & Tool Co., Lansing, Mich.
Modern Tool Co., Erie, Pa.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Toledo Machine & Tool Co., Toledo, O.

DIES (For Special Shapes).
Empire Art Metal Co., College Pt., N. Y.

DIES (Lettering and Embossing).
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pannier Bros. Stamp. Co., Pittsburgh, Pa.
Pittsburgh Steel Stamp Co., Pittsburgh, Pa.

DIES (Pipe Threading).
Treadwell Engineering Co., Easton, Pa.

DIGGING AND EXCAVATING MACHINERY.
Blaw Steel Construction Co., Pittsburgh, Pa.
Hayward Company, The, New York City.

DOLOMITE (Dead Burned).
Davison, Allen S., Company, Pittsburgh, Pa.

DOORS (Hollow Steel).
Empire Art Metal Co., College Pt., N. Y.

DOORS (Steel).
Trussed Concrete Steel Co., Detroit, Mich.

DRAFT YOKES.
Buckeye Steel Castings Co., The Columbus, O.

DRAW BENCHES.
Treadwell Engineering Co., Easton, Pa.

DRAWING TABLES.
Economy Drawing Table Co., Toledo, O.
Hein Furniture Co., The, Toledo, O.

DRILLING MACHINES.
Allen, John F., Co., New York, N. Y.
Baker Bros., Toledo, O.
Baush Machine Tool Co., Springfield, Mass.
Cleveland Pneumatic Tool Co., Cleveland, O.
Milwaukee Electric Crane & Mfg. Co., Milwaukee, Wis.
National Machine Co., The, Tiffin, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Simplex Mach. Tool Co., The, Cleveland, O.

DRILLS.
American Vanadium Co., The, Pittsburgh, Pa.
Baush Machine Tool Co., Springfield, Mass.
Clark Equipment Co., Buchanan, Mich.
Latrobe Tool Co., The, Latrobe, Pa.
Newton Mach. Tool Works, Inc., Philadelphia.
Wickes Brothers, Saginaw, Mich.

DRILLS (Twist).
Clark Equipment Co., Buchanan, Mich.

DRIVES (Rope and Gear).
Treadwell Engineering Co., Easton, Pa.

DRYERS (Ore).
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.

DRYERS (Vacuum).
Buffalo Foundry & Mach. Co., Buffalo, N. Y.

DUST ARRESTING SYSTEMS.
Hoevel Mfg. Corporation, New York City.
Pangborn Corporation, Hagerstown, Md.
Whiting Foundry Equipment Co., Harvey, Ill.

ELECTRICAL INSTRUMENTS (Repaired and Tested).
Stupakoff Laboratories, Pittsburgh, Pa.

ELECTRIC EQUIPMENT.
Electric Controller & Mfg. Co., Cleveland, O.

ELECTRIC LIGHT EQUIPMENT.
Link-Belt Company, Chicago, Ill.
Smith Gas Engrg. Co., The, Lexington, O.

ELEVATORS.
Ridgway, Craig & Son, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATORS (Bucket).
Link-Belt Company, Chicago, Ill.

ENGINE LATHES.
Bridgeford Mch. Tool Wks., Rochester, N. Y.

ENGINEERS AND CONTRACTORS.
Abramsen Engineering Co., Pittsburgh, Pa.
Alliance Structural Co., Alliance, O.
American Bridge Co., New York City.
Arnold Co., The, Chicago, Ill.
Blair Engineering Co., Chicago, Ill.
Case Crane & Engrg. Co., The, Columbus, O.
Demorest, George, M., Pittsburgh, Pa.
Eichleay, John Jr., Pittsburgh, Pa.
Freyn & Co., Chicago, Ill.
General Briquetting Co., New York City.
Hunt, Robert W., & Co., Chicago, Ill.
Kennedy, Julian, Pittsburgh, Pa.
Kratzer, W. N., & Co., Pittsburgh, Pa.
Laughlin, Alex. & Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
McClure, Geo. W., Sons & Co., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Pittsburgh, Pip'g & Equipment Co., Pittsburgh.
Rinehart, J. W., Cleveland, O.
Smythe, S. R., The, Co., Pittsburgh, Pa.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland.

ENGINEERS (Chemical).
Buffalo Foundry & Mach. Co., Buffalo, N. Y.

ENGINEERS (Consulting).
Arnold Co., The, Chicago, Ill.
Duff, Samuel E., Pittsburgh, Pa.
Freyn & Co., Chicago, Ill.
General Briquetting Co., New York, N. Y.
Kennedy, Julian, Pittsburgh, Pa.
Moore, Frederick C., Cleveland, O.
Moore, W. E., & Co., Pittsburgh, Pa.
Shover, Barton R., Pittsburgh, Pa.

ENGINEERS (Foundry, Mechanical and Electrical).
General Briquetting Co., New York City.
Standard Sand & Mch. Co., Cleveland, O.

ENGINEERS (Metallurgical).
American Incandescent Heat Co., Boston.

ENGINES (Gas, Gasoline and Oil).
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

ENGINES (Hoisting).
Dake Engine Co., Grand Haven, Mich.
Vulcan Iron Works, Wilkesbarre, Pa.

ENGINES (Marine).
Scranton Fdy. & Engine Works, New York.

ENGINES (Steam).
Cooper, C. & G., Co., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.

ENGRAVERS (Steel and Copper Plate).
Wiggins, John B., Co., Chicago, Ill.

ENGRAVERS (Steel, Die and Stamp).
Matthews, Jas. H., & Co., Pittsburgh, Pa.

EXCAVATING MACHINERY.
Blaw Steel Construction Co., Hoboken, Pa.
Hayward Company, The, New York City.
Lakewood Engrg. Co., Cleveland, O.

EXHAUSTERS (Gas).
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H. & F. M., Co., Connersville, Ind.

EYEBARS.
American Bridge Co., New York, N. Y.

FACINGS (Foundry).
Blystone Mfg. Co., Cambridge Springs, Pa.
Dixon, Jos., Crucible Co., Jersey City, N. J.

FENCE GATES.
American Steel & Wire Co., Chicago, Ill.

FENCING (Woven Wire).
Interstate Iron & Steel Co., Chicago, Ill.
Youngstown Sh't & Tube Co., Youngstown, O.

FERRO-ALLOYS.
Davison, Allen S., Co., Pittsburgh, Pa.

FERRO-CARBON TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO-MANGANESE.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Crocker Bros., New York City.
Mohr, J. J., & Sons, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.

FERRO-SILICON.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Crocker Bros., New York City.
Davison, Allen C., Company, Pittsburgh, Pa.
Globe Iron Co., Jackson, O.
Mohr, J. J., & Sons, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.

FERRO-TUNGSTEN.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

FERRO-VANADIUM
American Vanadium Co., Pittsburgh, Pa.

FILES.
Barnett, G. & H., Co., Philadelphia, Pa.
Disston, Henry & Sons, Inc., Philadelphia.
Nicholson File Co., Providence, R. I.

FIRE BRICK AND CLAY.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Brighton Fire Brick Co., New Brighton, Pa.
Clearfield Fire Brick Co., Clearfield, Pa.
Eureka Fire Brick Works, Mt. Braddock, Pa.
Fallston Fire Clay Co., Pittsburgh.
Harbison-Walker Refractories Co., Pittsburgh.
Kier Fire Brick Co., Pittsburgh, Pa.
Louisville Fire Brick Co., Highland Park, Ky.
Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.
Portsmouth Refractories Co., Portsmouth, O.
Pyro Clay Products Co., The, Oak Hill, Ohio.
Queens Run Fire Brick Co., Lock Haven, Pa.
Sharon Fire Brick Co., Sharon, Pa.
Soisson, Jos., Fire Brick Co., Connellsville Pa.
Union Mining Co., Mt. Savage, Md.
Wagner Fire Brick Co., Scranton, Pa.

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Botfield Specialties Co., Philadelphia.

FIRE CLAY (Ground).
Union Mining Co., Mt. Savage, Md.

FLANGES (Pipe).
Dart, E. M., Mfg. Co., Providence, R. I.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

FLAT WIRE—HIGH AND LOW CARBON.
American Steel & Wire Co., Chicago, Ill.

FLOORING (Cement).
Imperial Floor Co., Rochester, N. Y.

FLUE CUTTERS.
Clark Equipment Co., Buchanan, Mich.

FLUE WELDERS.
Southwark Foundry & Mach. Co., Philadelphia.

FLUOR-SPAR.
Rogers, Brown & Co., Cincinnati, O.

FLY WHEELS.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

FORGES.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.

FORGES (Blanking Die, New Head).
Crucible Steel Forge Co., Cleveland, O.

FORGING MACHINERY.
Billings & Spencer Co., Hartford, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Erie Foundry Co., The, Erie, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

FORGING (Drop).
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Billings & Spencer Co., The, Hartford, Conn.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
General Drop Forge Co., Buffalo, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Rockford Drop Forge Co., Rockford, Ill.
Scranton Forging Co., Scranton, Pa.
Steel Car Forge Co., Pittsburgh, Pa.
Williams, J. H., & Co., Brooklyn, N. Y.

FORGINGS (Iron and Steel).
American Bridge Co., New York, N. Y.
American Rolling Mill Co., Middletown, O.
American Steel Export Co., New York City.
American Vanadium Co., The, Pittsburgh, Pa.
Bay City Forge Co., Erie, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Buckeye Steel Castings Co., The, Columbus, O.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Crucible Steel Forge Co., Cleveland, O.
Cruse-Crawford Manufacturing Co., Birmingham, Ala.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
Federal Export Corporation, New York City.
Heppenstall Forge & Knife Co., Pittsburgh, Pa.
Ingall-Shepard Forging Co., Chicago, Ill.
McInnes Steel Co., Corry, Pa.
Midvale Steel Co., Philadelphia, Pa.
Morgan Engineering Co., Alliance, O.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.
Rockford Drop Forge Co., Rockford, Ill.
Steel Car Forge Co., Pittsburgh, Pa.
Williams, J. H., & Co., Brooklyn, N. Y.

FORMS (Concrete Construction).
Blaw Steel Construction Co., Pittsburgh, Pa.

FORMS (Special Wire).
American Steel & Wire Co., Chicago.

FOUNDRY EQUIPMENT AND SUPPLIES.
Arcade Mfg. Co., Freeport, Ill.
Blystone Mfg. Co., Cambridge Springs, Pa.
Hoevel Mfg. Corporation, New York City.
Lakewood Engrg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.
Pangborn Corporation, Hagerstown, Md.
Pridmore, Henry E., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FOUNDRY PLANTS.
Arnold Co., The, Chicago, Ill.

FRAMES (Wire Drawing).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FROGS (Railroad and Trolley).
Bethlehem Steel Co., The, So. Bethlehem, Pa.

FUEL OIL.
Texas Company, The, New York City.

FURNACE INSULATION.
Armstrong Cork & Insulation Co., Pittsburgh.
Botfield Specialties Co., Philadelphia.
Celite Products Co., New York, N. Y.

FURNACE SPECIALTIES.
Botfield Specialties Co., Philadelphia.

FURNACES (Annealing and Case Hardening).
American Incandescent Heat Co., Boston.
General Electric Co., Schenectady, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hagan, Geo. J., Co., Pittsburgh, Pa.
Mahr Mfg. Co., Minneapolis, Minn.
Metals Production Equipment Co., Springfield, Mass.
Morgan Construction Co., Worcester, Mass.
Rockwell, W. S., Company, New York City.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES (Blast).
Hagan, Geo. J., Co., Pittsburgh.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McClure, G. W., Son & Co., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Pennsylvania Engrg. Works, New Castle, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Smythe, S. R., Co., Pittsburgh.
Tod, Wm., Co., Youngstown, O.
Wellman-Seaver-Morgan Co., Cleveland.

FURNACES (Crucible).
Gilbert & Barker Mfg. Co., Springfield, Mass.
Laughlin, Alex., & Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES (Electric Steel).
Crowley, John A., Co., New York City.

FURNACES (Forging).
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mahr Mfg. Co., Minneapolis, Minn.
Metals Production Equipment Co., Springfield, Mass.

FURNACES (Heat Treating).
American Incandescent Heat Co., Boston.
Metals Production Equipment Co., Springfield, Mass.

FURNACES (Melting).
Mahr Mfg. Co., Minneapolis, Minn.

FURNACES (Open Hearth).
Blair Engineering Co., Chicago, Ill.
Lindsay, W. W., Co., Philadelphia, Pa.
McLain's System, Inc., Milwaukee, Wis.
Smythe, S. R., Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES (Shrapnel).
Gilbert & Barker Mfg. Co., Springfield, Mass.
Metals Production Equipment Co., Springfield, Mass.
Rockwell, W. S., Co., New York City.

FURNACES (Water Cooled Specialties for Open Hearth).
Knox Pressed & Welded Steel Co., Pittsburgh.

FURNACES (Wire Annealing).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNITURE (Steel).
Angle Steel Stool Co., Otsego, Mich.

GALVANIZED MATERIAL.
Larkin, J. K. & Co., New York City.

GALVANIZING.
Pittsburgh Galvanizing Co., Pittsburgh, Pa.

GALVANIZING EQUIPMENT.
American Bridge Co., New York.
Erie Foundry Co., Erie, Pa.

GALVANIZED WIRE (Equipment).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GAS BOOSTERS (Rotary Positive Pressure).
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H. & F. M., Co., Connersville, Ind.

GAS EXHAUSTERS.
Roots, P. H. & F. M., Co., Connersville, Ind.

GASKETS (Leather).
Graton & Knight Mfg. Co., The, Worcester, Mass.

GAS PRODUCERS.
Chapman Engineering Co., Mt. Vernon, O.
Hagan, Geo. J., Co., Pittsburgh, Pa.
Koppers, H., Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Smith Gas Engrg. Co., The, Lexington, O.
Wellman-Seaver-Morgan Co., Cleveland.

GAS RECOVERY COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

GAUGES (Caliper).
Williams, J. H., & Co., Brooklyn, N. Y.

GEAR CASES.
National Malleable Castings Co., Cleveland, O.

GEAR CUTTING MACHINERY.
Bilgram Machine Works, Philadelphia, Pa.
Newton Mach. Tool Wks., Inc., Philadelphia.

GEARS.
Treadwell Engineering Co., Easton, Pa.

GEARS (Rawhide).
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corp., Syracuse, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND GEAR CUTTING (Iron and Steel).
Acme Gear Works, New York City.
American Steel Foundries, Chicago, Ill.
American Vanadium Co., The, Pittsburgh, Pa.
Bilgram Machine Works, Philadelphia, Pa.
Camden Forge Co., Camden, N. J.
Dake Engine Co., Grand Haven, Mich.
Farrell Foundry & Machine Co., Ansonia, Ct.
Fawcus Machine Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott, Cleveland, O.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Link-Belt Company, Chicago, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., The, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Process Gear Corpn., Syracuse, N. Y.
Newton Mch. Tool Works, Inc., Philadelphia.
Pittsburgh Iron & Steel Foundries, Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Simonds Mfg. Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, William, Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATORS (Direct and Alternating Current).
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GLASS (Wire).
Trussed Concrete Steel Co., Detroit, Mich.

GRAPHITE.
Dixon, Jos., Crucible Co., Jersey City, N. J.

GRATE BARS.
Botfield Specialties Co., Philadelphia, Pa.
Green Engrg. Co., Chicago, Ill.
Treadwell Engineering Co., Easton, Pa.

GREASES.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Texas Company, The, New York City.

GRINDERS (Electric).
Wonder Grinder Co., Erie, Pa.

GRINDERS (Oil Stone).
Oliver Machy. Co., Grand Rapids, Mich.

GRINDING MACHINES.
Blake & Johnson Co., Waterbury, Conn.
Cincinnati Electric Tool Co., Cincinnati, O.
Cleveland Pneumatic Tool Co., Cleveland, O.
Gardner Machine Co., Beloit, Wis.
Modern Tool Co., Erie, Pa.
Newton Mch. Tool Works, Inc., Philadelphia.
Ransom Mfg. Co., Oshkosh, Wis.

GRINDING PANS.
American Clay Machinery Co., Bucyrus, O.
Phillips & McLaren Co., Pittsburgh, Pa.

GRINDING AND POLISHING MACHINERY, SUPPLIES AND ACCESSORIES.
Gardner Machine Co., Beloit, Wis.

GUARDS (Machinery).
Erdle Perforating Co., Rochester, N. Y.

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and Steel Castings

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STEEL CASTINGS

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GUIDES (For Wire, Rod and Billet Mills).
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

HAMMERS (Drop).
Alliance Machine Co., Alliance, O.
Beaudry & Co., Inc., Boston, Mass.
Billings & Spencer Co., The, Hartford, Conn.
Bliss, E. W., Co., Brooklyn, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy Co., Pittsburgh, Pa.
United Hammer Co., Boston, Mass.

HAMMERS (Link Welding).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

HAMMERS (Power).
Beaudry & Co., Inc., Boston, Mass.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y
O. M. S. Company, The, Chicago, Ill.
Toledo Machine & Tool Co., Toledo, O.
United Hammer Co., Boston, Mass.

HAMMERS (Rawhide).
Chicago Rawhide Mfg. Co., Chicago, Ill.

HARDWARE (Wagon).
Oliver Iron & Steel Co., Pittsburgh, Pa.

HEAT INSULATING (Brick and Powder).
Celite Products Co., New York, N. Y.

HEAT TREATING.
Bidle, W. S., Co., Cleveland, O.
Roberts Mfg. Co., Lockport, N. Y.
Steel Improvement & Forge Co., Cleveland, O.

HOISTING MACHINERY.
Alliance Machine Co., Alliance, O.
Browning Co., The, Cleveland, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Dake Engine Co., Grand Haven, Mich.
Enclid Crane & Hoist Co., Euclid, O.
Hendrick Mfg. Co., Carbondale, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Link-Belt Company, Chicago, Ill.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York City.
Northern Engrg. Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
O. M. S. Company, The, Chicago, Ill.
Ridgway, Craig & Son, Coatesville, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Wellman-Seaver-Morgan Co., Cleveland.
Whiting Foundry Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York City.

HOOPS AND BANDS.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
West Leechburg Steel Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

HOOPS (Wire.)
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES AND CALKS.
American Steel & Wire Co., Chicago, Ill.

HOSE (Pneumatic).
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.

HOT BEDS.
Treadwell Engineering Co., Easton, Pa.

HYDRAULIC MACHINERY.
Lourie Mfg. Co., Springfield, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

INDUSTRIAL PLANTS.
Arnold Co., The, Chicago, Ill.

INGOT AND OPEN HEARTH CHARGING CARS.
Pennsylvania Engrg. Works, New Castle, Pa.
Treadwell Engineering Co., Easton, Pa.

INGOTS.
Buckeye Steel Castings Co., Columbus, O.
Interstate Iron & Steel Co., Chicago, Ill.

INGOT CARS.
Lakewood Engrg. Co., Cleveland, O.

INGOT MOLDS.
Marshall Foundry Co., Pittsburgh, Pa.
Penn Mold & Mfg. Co., Wheeling, W. Va.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

INGOT (Electric Furnace Steel).
Crucible Steel Forge Co., Cleveland, O.
Latrobe Electric Steel Co., Latrobe, Pa.

INSPECTORS (Heat Treated Metal).
Pennsylvania Inspection Bureau, Johnstown, Pa.

INSTRUMENTS (Electric Indicating and Recording).
General Electric Co., Schenectady, N. Y.
Smith Gas Engrg. Co., The, Lexington, O.

INSULATING BRICK.
Armstrong Cork & Insulation Co., Pittsburgh.
Botfield Specialties Co., Philadelphia.
Celite Products Co., New York, N. Y.
Wagner Fire Brick Co., Scranton, Pa.

INSULATION (Furnaces, Boiler Settings, Ovens, Steam Pipe, Etc.).
Armstrong Cork & Insulation Co., Pittsburgh.
Celite Products Co., New York, N. Y.

IRON.
American Vanadium Co., The, Pittsburgh, Pa.
Andrews Steel Co., Newport, Ky.
Beals & Co., Buffalo, N. Y.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Brown-Wales Co., Boston, Mass.
McCalla, Harold, Philadelphia, Pa.
Newport Rolling Mill Co., Newport, Ky.
Pittsburgh Tool Steel Wire Co., Monaca, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Westerman & Co., Lockport, N. Y.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

IRON (Bar).
St. Louis Screw Co., St. Louis, Mo.

IRON (Ornamental).
Belmont Iron Works, Philadelphia, Pa.

IRON (Silvery).
Globe Iron Co., Jackson, O.

IRON AND STEEL (Scrap).
American Bridge Co., New York, N. Y.

IRON AND TIMBER LANDS.
Neely, Benjamin C., Crystal Falls, Mich.

IRON ORE.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Breitung, E. N., & Co., Cleveland, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
Snyder, W. P., & Co., Pittsburgh, Pa.
Tod-Stambaugh, Co., Cleveland, O.
Wharton Steel Co., New York City.

JIGS, FIXTURES AND TOOLS.
Blodgett Engrg. & Tool Co., Detroit, Mich.
Feeney Tool Co., The, Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, O.
Scott, Geo. H., Machine Co., Cleveland, O.

JOLT RAMMING MACHINES.
Pridmore, Henry E., Chicago, Ill.

KEYS AND COTTERS (Machine).
Moltrup Steel Products Co., Beaver Falls, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Standard Gauge Steel Co., Beaver Falls, Pa.
Williams, J. H., & Co., Brooklyn, N. Y.

KEYSEATERS.
Baker Bros., Toledo, O.

LABORATORIES.
Hunt, Robert W., & Co., Chicago, Ill.

LADLE BOWLS (Steel).
Byram Company, Detroit, Mich.

LADLE BRICK.
Fallston Fire Clay Co., Pittsburgh.

LADLES.
Northern Engineering Works, Detroit, Mich.
Pennsylvania Engrg. Works, New Castle, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

LAMPS (Arc and Incandescent).
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LATH (Expanded Metal).
Trussed Concrete Steel Co., Detroit, Mich.

LATHES.
Acme Machine Tool Co., Cincinnati, O.
Bullard Machine Tool Co., Bridgeport, Conn.
Cincinnati Iron & Steel Co., Cincinnati, O.
Greaves-Klusman Co., Cincinnati, O.
Jones & Lamson Mach. Co., Springfield, Vt.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Britain Mach. Co., New Britain, Conn.
Niles-Bement-Pond Co., New York, N. Y.
Oliver Machy. Co., Grand Rapids, Mich.
Simplex Mach. Tool Co., The, Cleveland, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Warner & Swasey Co., Cleveland, O.
Youngstown Fdy. & Mch. Co., Youngstown, O.

LATHES (Chucking, Vertical).
Bullard Machine Tool Co., Bridgeport, Conn.

LATHES (Vertical Turret).
Bullard Machine Tool Co., Bridgeport, Conn.

LATHE DOGS (Safety).
Williams, J. H., & Co., Brooklyn, N. Y.

LEATHER (Hydraulic).
Graton & Knight Mfg. Co., Worcester Mass

LEATHER BELTING (See Belting, Leather).

LETTERS AND FIGURES (Steel, Hand Made).
Matthews, Jas. H., & Co., Pittsburgh, Pa.

LETTERHEADS (Engraved).
Wiggins, John B., Co., Chicago, Ill.

LIFTING MAGNETS.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.

LIMESTONE.
Davison, Allen S., Co., Pittsburgh, Pa.

LIMESTONE (Crushed).
Davison, Allen S., Co., Pittsburgh, Pa.

LININGS (Cupola, Furnace and Forge).
Botfield Specialties Co., Philadelphia.
Harbison-Walker Refractories Co., Pittsburgh.
Louisville Fire Brick Wks., Highland Park, Ky.
Mutton Hollow Fire Brick Co., Woodbridge, N. J.
U. S. Magnesite Corp., New York City.
Wagner Fire Brick Co., Scranton, Pa.

LINK BELTING.
Link-Belt Company, Chicago, Ill.

LOCOMOTIVES.
General Electric Co., Schenectady, N. Y.
Vulcan Iron Works, Wilkesbarre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES (Electric).
Atlas Car & Mfg. Co., Cleveland, O.
Baldwin Locomotive Works, Philadelphia, Pa.

LOCOMOTIVES (Second Hand).
Zelnicker, Walter A., Supply Co., St. Louis.

LUBRICANTS.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Texas Company, The, New York City.

LUMBER (Boxing, Crating, Flask, Pattern and Templet).
Johnson Lumber Co., Milwaukee, Wis.

MACHINE COUNTERS.
Hart, R. A., Mfg. Co., Battle Creek, Mich.

MACHINE KEYS (See Keys and Cotters, Machine).

MACHINE WORK.
Brenbunfers Engrg. Co., Lorain, O.
Diamond Machine Co., Monongahela, Pa.
Evinrude Motor Co., Milwaukee, Wis.
Poorman, O. O., Co., New Bremen, O.
Smalley-General Co., Bay City, Mich.

MACHINERY (See Second Hand Machinery).

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

CASTINGS

PITTSBURGH MALLEABLE IRON CO.
MALLEABLE CASTINGS
Pittsburgh, Penna.

ZANESVILLE MALLEABLE CO.
MALLEABLE CASTINGS
ZANESVILLE, OHIO

CHARCOAL 90% MALLEABLES
Our only product—and ours only.
STANDARD MALLEABLE IRON COMPANY
Muskegon Michigan

Belle City Malleable Iron Company
Malleable Iron Castings
Racine Steel Castings Company
Refined Electric Steel Castings
RACINE, WISCONSIN

MISSOURI MALLEABLE IRON CO.
Highest Grade Malleable Iron Castings
Capacity 25,000 Tons Per Annum EAST ST. LOUIS, ILL.

Light and Heavy
GRAY IRON CASTINGS
Marine Engines Ship Propellers
Ship Framing Work Brass Castings
QUICK SERVICE RELIABLE WORK
Scranton Foundry & Engine Works, Inc.
Works: Scranton, Pa. New York Office: 5 Nassau Street

Malleable Iron Castings
DECATUR
MALLEABLE IRON COMPANY
Decatur, Illinois

THE MARION MALLEABLE IRON WORKS
MARION, INDIANA
MALLEABLE CASTINGS
for General Purposes

SAND BLAST CLEANED
CASTINGS
Quality, finish and service unsurpassed.
Acme Steel & Malleable Iron Works, Inc.
BUFFALO, N. Y.

Refined Air Furnace Malleable Castings.
LAKESIDE MALLEABLE CASTINGS CO. RACINE, WIS.

MACHINERY (Spetial).

Feeney Tool Co., The, Bridgeport, Conn.
Lammert & Mann Co., Chicago, Ill.
Shepherd Engineering Co., Williamsport, Pa.
Treadwell Engineering Co., Easton, Pa.
Wheeling Mold & Foundry Co., Pittsburgh.

MACHINISTS.

Adamson Machine Co., Akron, O.
Air Tight Steel Tank Co., Pittsburgh, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Brooklyn, N. Y.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Case Crane & Engrg. Co., The, Columbus, O.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Fawcus Machine Co., Pittsburgh, Pa.
Hanna Engineering Works, Chicago, Ill.
Hill Pump Valve Co., Chicago, Ill.
Klotz Machine Co., Sandusky, O.
Link-Belt Company, Chicago, Ill.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, O.
Murray Iron Works Co., Burlington, Iowa.
Tod, Wm., Youngstown, O.
Toledo Mach. & Tool Co., Toledo, O.
Treadwell Engineering Co., Easton, Pa.

MAGNESITE.

American Mineral Production Co., Chicago, Ill.
American Refractories Co., Chicago, Ill.
Davison, Allen S., Co., Pittsburgh, Pa.
U. S. Magnesite Corp., New York City.

MAGNESITE (Calcined, Crude, Dead Burned).

American Mineral Production Co., Chicago, Ill.
Davison, Allen S., Co., Pittsburgh, Pa.
U. S. Magnesite Corp., New York City.

MAGNETIC SEPARATORS.

Cutler-Hammer, The, Mfg. Co., Milwaukee.

MASON CONTRACTORS (Blast Furnace Work).

Rinehart, J. W., Cleveland, O.

MERCANTILE AGENCIES

Iron & Steel Board of Trade, New York City.

MERCHANT MILL EQUIPMENT.

Treadwell Engineering Co., Easton, Pa.

METAL (Acid Proof).

Keystone Bronze Co., Pittsburgh, Pa.

METAL CLEANER.

Ford, J. B., Co., Wyandotte, Mich.

METAL CUTTING TOOLS (Stellite).

Haynes Stellite Co., The, Kokomo, Ind.

METAL SPECIALTIES AND PARTS.

Erdle Perforating Co., Rochester, N. Y.
White, L. & I. J., Co., Buffalo, N. Y.

METALLURGY OF IRON.

McLain's System, Inc., Milwaukee, Wis.

METALLURGISTS.

Cleveland Metal Treating & Welding Co., Cleveland, O.
Haynes Stellite Co., The, Kokomo, Ind.
Hunt, Robert W., & Co., Chicago, Ill.
Steel Improvement & Forge Co., Cleveland, O.

METAL (Notch, Bar and Ingot).

Pittsburgh Aluminum Co., Pittsburgh, Pa.

METAL (Perforated).

Erdle Perforating Co., Rochester, N. Y.

METALS (Non-Ferrous).

Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Lubricating Metal Co., The, New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

MILL AND MINE SUPPLIES.

Dake Engine Co., Grand Haven, Mich.
Lunkenheimer Co., The, Cincinnati, O.

MILL WEARING PARTS.

Midvale Steel Co., The, Philadelphia, Pa.

MILLING CUTTERS.

Cleveland Milling Machine Co., Cleveland, O.

MILLING MACHINES.

Cincinnati Milling Mach. Co., Cincinnati, O.
Cleveland Milling Machine Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Kempsmith Mfg. Co., Milwaukee, Wis.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Oliver Machinery Co., Grand Rapids, Mich.

MILLS (Blooming, Universal, Plate, Sheet, Tin, Bar).

Mesta Machine Co., Pittsburgh, Pa.
Treadwell Engineering Co., Easton, Pa.

MILLS (Boring and Turning, Vertical).

Bullard Machine Tool Co., Bridgeport, Conn.

MINING MACHINERY.

Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.

MINING OPTIONS AND LEASES.

Neely, Benjamin C., Crystal Falls, Mich.

MIXERS (Concrete).

Blystone Mfg. Co., Cambridge Springs, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.

MIXERS (Hot Metal).

Pennsylvania Engineering Works, New Castle, Pa.
Treadwell Engineering Co., Easton, Pa.

MIXERS (Sand).

Blystone Mfg. Co., Cambridge Springs, Pa.
Dunning, W. D., Syracuse, N. Y.

MOLDS (Concrete).

Blaw Steel Construction Co., Pittsburgh, Pa.

MOLDS (Ingot).

Penn Mold & Mfg. Co., Wheeling W. Va.

MOLDING MACHINES.

Arcade Mfg. Co., Freeport, Ill.
Pridmore, Henry E., Chicago, Ill.

MOLDING (Automobile).

Empire Art Metal Co., College Pt., N. Y.

MONEL METAL.

Williams & Co., Pittsburgh, Pa.

MOTOR (Air).

Dake Engine Co., Grand Haven, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS (Electric).

Carrell, W. A., & Co., Pittsburgh, Pa.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Service Supply & Equip. Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS (Second Hand).

Klein, Nathan, & Co., Inc., New York City.
Miller-Owen Electric Co., Pittsburgh, Pa.
Service Supply & Equip. Co., Pittsburgh, Pa.

MOTOR TRUCKS.

Federal Motor Truck Co., Detroit, Mich.

MUFFLERS (Wire Mill Equipment).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

NAIL MACHINERY (Wire).

Sleeper & Hartley, Inc., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

NAIL MACHINERY.

Kilby Mfg. Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Sleeper & Hartley, Inc., Worcester, Mass.

NAILS.

American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Philadelphia, Pa.
Interstate Iron & Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Larkin, J. K., & Co., New York City.
Youngstown Sheet & Tube Co., Youngstown, O.

NAILS (Copper).

American Steel & Wire Co., Chicago, Ill.

NAILS, WIRE (Coated).

Continental Steel & Supply Co., Pittsburgh.
Larkin, J. K., & Co., New York City.

NAME PLATES (Cast, Bronze, Stamped and Etched).

Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pannier Bros. Stamp Co., Pittsburgh, Pa.

NICKEL.

Williams & Co., Inc., Pittsburgh.

NUTS (See Bolts and Nuts).

NUTS (Hot Pressed).

Bourne-Fuller Co., Cleveland, O.
St. Louis Screw Co., St. Louis, Mo.
Upson Nut Company, Cleveland, O.

NUTS (Semi-Finished).

St. Louis Screw Co., St. Louis, Mo.
Upson Nut Company, Cleveland, O.

OIL CANS.

New Britain Machine Co., New Britain, Conn.

OPEN HEARTH FURNACES (See Furnaces—Open Hearth).

ORDNANCE.

Midvale Steel Co., Philadelphia, Pa.

ORE (Chrome).

Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.

ORE (Lead).

Amer. Zinc, Lead & Smelt'g Co., New York.

ORE (Zinc.)

Amer. Zinc, Lead & Smelt'g Co., New York.

ORE DOCKS.

American Bridge Co., New York, N. Y.

ORE HANDLING MACHINERY.

Blaw Steel Construction Co., Pittsburgh, Pa.
Brown Hoisting Machinery Co., Cleveland, O.
Hayward Company, The, New York City.

OVENS (Coke, By-Product Recovery).

Koppers, H., Co., Pittsburgh, Pa.

OXY-ACETYLENE WELDING AND CUTTING.

Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

OXYGEN.

Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

PACKING (Metallic).

Lubricating Metal Co., The, New York, N. Y.

PACKING (Leather).

Graton & Knight Mfg. Co., Worcester, Mass.

PAINT (Silica-Graphite).

Dixon, Jos., Crucible Co., Jersey City, N. J.

PANS (Grinding).

American Clay Machinery Co., Bucyrus, O.

PANS (Lathe and Shop).

American Bridge Co., New York, N. Y.
New Britain Mach. Co., New Britain, Conn.

PATTERNS (Wood and Metal).

Acme Steel & Mall, Iron Wks., Inc., Buffalo.
Allison Pattern Works, Dayton, O.
Arcade Mfg. Co., Freeport, Ill.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Buffalo Pattern Works, Buffalo, N. Y.
Corbett-Steeves Pattern Wks., Rochester N. Y.
Diamond Machine Co., Monongahela, Pa.
Empire Art Metal Co., College Pt., N. Y.
Ironton Engine Co., Ironton, O.
Marion Malleable Iron Works, Marion, Ind.
Ohmer Fare Register Co., Dayton, O.
Pridmore, Henry E., Chicago, Ill.
Standard Pattern Works, Canton, Ohio.
Wellman Pattern Supply Co., Cleveland, O.

PATTERN SHOP EQUIPMENT AND SUPPLIES.

Oliver Machinery Co., Grand Rapids, Mich.

PERFORATED METAL.

Erdle Perforating Co., Rochester, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.

PHOTOGRAPHY (Commercial).

Photo Products Co., Pittsburgh, Pa.

PIERCING POINTS, PLUGS AND BALLS (For Tube Mills).

Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

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CASTINGS

Dayton Malleable Iron Co.
Dayton, Ohio

CASTINGS
FINE LIGHT GRAY IRON
North Buffalo Hardware Foundry
BUFFALO, N. Y.

Automobile Castings
The Allyne-Ryan Foundry Co.
CLEVELAND

MALLEABLE CASTINGS
We positively guarantee Quality and Deliveries
THE COLUMBUS MALLEABLE IRON CO.
COLUMBUS, OHIO

THE MAL-GRA CO.
CASTINGS

High Grade Malleables

Air Furnace Process

Quality Guaranteed

Office and Foundry at
CAMBRIDGE CITY
INDIANA

ERIE MALLEABLE IRON COMPANY
ERIE, PA.

THE DAYTON STEEL FOUNDRY CO.
Quality
HIGH GRADE STEEL CASTINGS AUTOMOBILE CASTINGS A SPECIALTY
Service
DAYTON, OHIO.

Atlas Steel Casting Company
General Office and Works:
BUFFALO, N. Y.
Acid Open Hearth Steel Castings Exclusively
Frank D. Moffat & Co., New York and New England
Sales Agent, 81 Fulton Street, New York

Malleable Iron Castings
Quality and Service
The Danville Malleable Iron Company
DANVILLE, ILLINOIS

CASTINGS
Gray Iron Semi-Steel
From 1 pound to 4000 pounds.
CALDWELL & DRAKE IRON WORKS
COLUMBUS, IND.

PIG IRON.

Addy, The Matthew, Co., Cincinnati, O.
Baird & West, Detroit, Mich.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Crocker Bros., New York, N. Y.
Davison, Allen S., Co., Pittsburgh, Pa.
Domhoff & Joyce Co., The, Cincinnati, O.
Eaton, Rhodes & Co., Cincinnati, O.
Globe Iron Co., Jackson, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
McKeefrey & Co., Leetonia, O.
Mitchell-Diggins Iron Co., Cadillac, Mich.
Mohr, J. J., & Son, Philadelphia, Pa.
Mudge, Edmund W., & Co., Pittsburgh, Pa.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Struthers Furnace Co., The, Cleveland, O.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Thomas Furnace Co., Milwaukee, Wis.
Upson Nut Co., Cleveland, O.
Wharton Steel Co., New York City.
Wickwire Steel Co., Buffalo, N. Y.

PIG IRON BREAKERS.

Brown Hoisting Machinery Co., Cleveland, O.

PILE DRIVERS.

Industrial Works, Bay City, Mich.

PILING (Steel Sheet).

Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PINIONS (See Gears).

PINS.

American Vanadium Co., The, Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.

PIPE (Cast Iron).

American Cast Iron Pipe Co., Birmingham, Ala.
Clow, James B., & Sons, Chicago, Ill.
Donaldson Iron Co., Emaus, Lehigh Co., Pa.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Lynchburg Fdy. Co., Lynchburg, Va.
Massillon Iron & Steel Co., Massillon, O.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Warren Foundry & Machine Co., New York.

PIPE (Culvert).

Newport Rolling Mill Co., Newport, Ky.

PIPE (Iron and Steel).

American Bridge Co., New York, N. Y.
American Steel Export Co., New York City.
Bourne-Fuller Co., The, Cleveland, O.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Byers, A. M., Co., Pittsburgh, Pa.
Central Tube Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
La Belle Iron Works, Steubenville, O.
Larkin, J. K., & Co., New York City.
Mark Mfg. Company, Evanston, Ill.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Republic Iron & Steel Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Youngstown Sh't & Tube Co., Youngstown, O.

PIPE (Steel).

Larkin, J. K., & Co., New York City.
National Tube Co., Pittsburgh, Pa.
Wheeling Steel & Iron Co., Wheeling, W. Va.
Youngstown Sh't & Tube Co., Youngstown, O.

PIPE (Wrought Iron).

Bourne-Fuller Co., The, Cleveland, O.
Byers, A. M., Co., Pittsburg, Pa.
Larkin, J. K., & Co., New York City.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Youngstown Sh't & Tube Co., Youngstown, O.

PIPE BENDS.

Roessing-Ernst Co., Etna, Pittsburgh, Pa.

PIPE COVERING (Steam and Cold Water).

Armstrong Cork & Insulation Co., Pittsburgh.

PIPE FITTINGS.

Illinois Malleable Iron Co., Chicago, Ill.
Lunkenheimer Co., The, Cincinnati, O.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Southwark Fdy. & Mach. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PIPE MILL MACHINERY.

Landis Machine Co., Waynesboro, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PIPE MOLDS (Concrete).

Blaw Steel Construction Co., Hoboken, Pa.

PIPE TAGS.

Matthews, Jas. H., & Co., Pittsburgh, Pa.

PIPE THREADING MACHINERY.

Standard Engrg. Co., Elwood City, Pa.
Treadwell Engineering Co., Easton, Pa.

PIPING CONTRACTORS.

Pittsburgh Piping & Equip. Co., Pittsburgh.

PISTON RODS.

Bay City Forge Co., Erie, Pa.
Heppenstall Forge & Knife Co., Pittsburgh.

PLANERS.

Cincinnati Planer Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mch. Tool Works, Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

PLATES (Rolled Steel—Floor).

Carnegie Steel Co., Pittsburgh, Pa.
Trussed Concrete Steel Co., Detroit, Mich.
Wood, Alan, Iron & Steel Co., Philadelphia.

PLATES (Sheared and Universal).

Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Nagel Steel Co., Pottstown, Pa.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
Whitaker-Glessner Co., Portsmouth, Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Worth Bros. Co., Philadelphia, Pa.
Youngstown Sh't & Tube Co., Youngstown, O.

PLATES (Terne and Tin).

American Sheet & Tin Plate Co., Pittsburgh.

PLATES (Vanadium Steel).

American Vanadium Co., The, Pittsburgh, Pa.

PLUGS (Base).

Bogert & Hopper, New York City.

PLUNGERS (For Pumps).

Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

POINTERS (Wire and Rod).

Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

POLE LINE HARDWARE (Plain and Galvanized).

Michigan Bolt & Nut Works, Detroit, Mich.

POLISHING MACHINERY.

Gardner Machine Co., Beloit, Wis.

POSTS (Steel Fence).

American Steel & Wire Co., Chicago, Ill.

POTS (Lead and Cyanide).

Blackwood Steel Fdy Co., The, Springfield, O.

POULTRY NETTING.

American Steel & Wire Co., Chicago, Ill.

POWDERED COAL EQUIPMENT.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
Metals Production Equipment Co., Springfield, Mass.
Raymond Bros. Impact Pulverizer Co., The, Chicago, Ill.

POWER PLANTS.

Arnold Co., The, Chicago, Ill.

POWER TOOLS.

Southwark Foundry & Mach. Co., Philadelphia.

POWER TRANSMITTING MACHINERY.

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Link-Belt Co., Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Treadwell Engineering Co., Easton, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PRESSES.

Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
General Briquetting Co., New York City.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

PRESSES (Power).

Etna Machine Co., Toledo, O.

PRESSURE GAGES.

Clark, Chas. J., Chicago, Ill.

PRESSURE REGULATORS.

Connersville Blower Co., The, Connersville, Ind.
Electric Controller & Mfg. Co., Cleveland, O.

PROJECTILES.

Midvale Steel Co., Philadelphia, Pa.

PULLEYS (Wood-Split).

Excelsior Pulley Co., The, Cuba, N. Y.

PULVERIZING MILLS.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
Raymond Bros. Impact Pulverizer Co., The, Chicago, Ill.

PUMPS.

Aldrich Pump Co., Allenton, Pa.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Connersville Blower Co., The, Connersville, Ind.
Dake Engine Co., Grand Haven, Mich.
Dean Bros. Steam Pump Works, Indianapolis, Ind.
Deming Co., Salem, O.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Mesta Machine Co., Pittsburgh, Pa.
Roots, P. H., & F. M., Co., Connersville, Ind.
Standard Scale & Supply Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.

PUNCHING AND SHEARING MACHINERY.

Allen, John F., Co., New York, N. Y.
Alliance Machine Co., Alliance, O.
Bliss, E. W., Co., Brooklyn, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Richards, I. P., Providence, R. I.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Bridge Tool Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wickes Brothers, Saginaw, Mich.
Wood, R. D., & Co., Philadelphia, Pa.

PUSH BUTTONS.

Electric Controller & Mfg. Co., Cleveland, O.

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C. E. BLUE, Pres.
H. S. BRADLEY, Vice Pres.
H. S. SANDS, Treas.
W. V. HOGE, Gen'l Mgr.

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are made in a large variety of sizes, capable of all classes of work from the

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On account of its simplicity of construction it has longer life and requires less repairing than other tools.
We also specialize Riveting Hammers and Foundry Rammers.

Geo. Oldham & Son Company
Frankford, Philadelphia, Pa.

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Pittsburgh, Pa.

Ingot Molds Gray Iron Castings
Capacity 600 Tons per day

SAND-BLAST EQUIPMENT

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HAGERSTOWN, MD.
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and all kinds of
Match Plates

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is a patented Automatic Filling Valve that eliminates elevating buckets, chains, overhead hoppers. No sand valves to wear. 30% to 50% higher efficiency than any suction system. Less than half the mechanism of any other pressure system.

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SAFETY LATHE DOGS

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"Watch the West Cast-Steel Wheels go round."

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FOR SEVERE SERVICE
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STOVE TRIMMINGS
Malleable Iron Castings
Foundry Chaplets, Tumbling Stars
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THE FANNER MFG. CO. Cleveland, Ohio

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Rolling Mill and Blast Furnace castings to withstand long hard service should be—

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QUALITY CASTINGS

from Brass, Bronze, Copper or Aluminum
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KEYSTONE BRONZE COMPANY
Gen. Offices, 39th St., Pittsburgh, Pa.

PORTAGE SANDS
Quality and Service
THE PORTAGE SILICA CO.
Youngstown Ohio

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PYROMETERS.
Stupakoff Laboratories, Pittsburgh, Pa.

RACKS (Steel or Tool).
Angle Steel Stool Co., Otsego, Mich.
Empire Art Metal Co., Inc., College Pt., N. Y.
New Britain Mach. Co., New Britain, Conn.

RAIL BONDS.
American Steel & Wire Co., Chicago, Ill.

RAIL JOINTS.
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

RAILROAD EQUIPMENT (Industrial).
Lakewood Engrg. Co., Cleveland, O.

RAILROAD SUPPLIES.
American Steel Export Co., New York City.
Federal Export Corporation, New York City.
Mitshkum Co., M., Detroit, Mich.
Zelnicker, Walter A., Supply Co., St. Louis, Mo.

RAILS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

RAILS (Girder).
Bethlehem Steel Co., The, So. Bethlehem, Pa.

RAILS (High Tee).
Bethlehem Steel Co., The, So. Bethlehem, Pa.

REAMERS.
Clark Equipment Co., Buchanon, Mich.

REAMERS (Bridge).
Latrobe Tool Co., The, Latrobe, Pa.

REELS (Wire Mill Equipment).
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

RELAYS (Pressure and Vacuum).
Cutler-Hammer Mfg. Co., Milwaukee, Wis.

RETORTS (Cast Iron).
Buffalo Foundry & Mach. Co., Buffalo, N. Y.

RHEOSTATS.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.

RINGS (Steel and Forged).
Akron-Selle Co., The, Akron, O.

RINGS (Steel, Weldless).
Bay City Forge Co., Erie, Pa.
Camden Forge Co., The, Camden, N. J.
Crucible Steel Forge Co., Cleveland, O.

RIVETING MACHINERY.
Allen, John F., Co., New York, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Engineering Works, Chicago, Ill.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

RIVETS.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Larkin, J. K., & Co., New York City.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
National Bolt & Nut Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

RODS (Brass, Bronze and Aluminum).
Gardner, B. M., Company, Cleveland, O.

RODS (Connecting).
Bay City Forge Co., Erie, Pa.
Camden, Forge Co., Camden, N. J.
Crucible Steel Forge Co., Cleveland, O.

RODS (Drill).
Bourne-Fuller Co., The, Cleveland, O.
Kidd Drawn Steel Co., Aliquippa, Pa.
Pittsburgh Tool Steel Wire Co., Monaca, Pa.
Superior Steel & Iron Co., New York City.

RODS (Iron and Steel).
American Steel Export Co., New York City.
American Steel & Wire Co., Chicago, Ill.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Federal Export Corporation, New York City.
Upson Nut Co., Cleveland, O.
Youngstown Sh't & Tube Co., Youngstown, O.

RODS (Upset).
Larkin, J. K., & Co., New York City.

ROLLING MILLS (For Laboratory Use).
Crocker, Samuel A., Co., Cincinnati, O.

ROLLING MILL EQUIPMENT.
Abramsen Engrg. Co., Pittsburgh, Pa.
Alliance Machine Co., Alliance, O.
Blake & Johnson Co., Waterbury, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Farrel Foundry & Machine Co., Ansonia, Ct.
Fawcus Machine Co., Pittsburgh, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Industrial Works, Bay City, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Morgan Engineering Co., Alliance, O.
Newbold, R. S., & Son Co., Norristown, Pa.
Standard Engineering Co., Ellwood City, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
Wellman-Seaver-Morgan Co., Cleveland.
Wheeling Mold & Fdy. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

ROLLING MILL TABLES.
Treadwell Engineering Co., Easton, Pa.

ROLLS.
Camden Forge Co., Camden, N. J.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Wheeling Mold & Foundry Co., Pittsburgh.

ROLLS (Adamite).
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

ROLLS (Bending and Straightening).
United Engrg. & Fdy. Co., Pittsburgh, Pa.

ROLLS (Forged Steel).
Bay City Forge Co., Erie, Pa.

ROLLS (Sand Chilled and Steel).
American Steel Foundries, Chicago, Ill.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Farrel Fdy. & Mach. Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Roll & Foundry Co. Avonmore Pa.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa
Seaman, Sleeth & Co., Pittsburgh, Pa.
Standard Engrg. Co., Ellwood City, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wheeling Mold & Foundry Co., Pittsburgh.
Youngstown Fdy. & Mch. Co., Youngstown, O.

ROLLS (Steel).
Wheeling Mold & Foundry Co., Pittsburgh.

ROLLS (Wood).
Dart, E. M., Mfg. Co., Providence, R. I.

ROOFING AND SIDING (Composite).
American Sheet & Tin Plate Co., Pittsburgh.
Texas Company, The, New York City.

ROOFING AND SIDING (Iron and Steel).
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

ROPE DRESSING.
Texas Company, The, New York City.

RUNNING GEAR WHEELS, AXLES AND BEARINGS.
Lakewood Engrg. Co., Cleveland, O.

SAFE ENDS (Boiler Tube).
Worth Brothers Co., Philadelphia, Pa.

SAND.
Enterprise Sand Co., Pittsburgh, Pa.
Gordon Sand Co., Inc., The, Conneaut, O.
Portage Silica Co., Youngstown, O.
Standard Sand & Machine Co., Cleveland, O.

SAND BLAST (Shot).
Globe Steel Co., Mansfield, O.

SAND BLAST EQUIPMENT AND ACCESSORIES.
American Foundry Equipment Co., New York City.
Hoevel Mfg. Corporation, New York City.
Pangborn Corporation, Hagerstown, Md.

SAND BLAST ROOMS WITH REVOLVING TABLES.
American Fdy. Equip. Co., New York City.
Hoevel Mfg. Corporation, New York City.
Pangborn Corporation, Hagerstown, Md.

SAND BLAST SAND.
Portage Silica Co., The, Youngstown, O.

SAND BLAST TUMBLING BARRELS.
American Fdy. Equip. Co., New York City.
Hoevel Mfg. Corporation, New York City.
Pangborn Corporation, Hagerstown, Md.

SAND CONVEYING AND HANDLING MACHINERY.
Blaw Steel Construction Co., Pittsburgh, Pa.
Dunning, W. D., Syracuse, N. Y.
Link-Belt Company, Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.

SAND CUTTING MACHINERY.
American Foundry Equipment Co., New York City.

SAND DRYERS.
Indiana Foundry Co., Indiana, Pa.

SAND MIXING MACHINERY.
Blystone Mfg. Co., Cambridge Springs, Pa.
Dunning, W. D., Syracuse, N. Y.
Standard Sand & Machine Co., Cleveland, O.

SAND RECLAIMERS.
American Clay Machinery Co., Bucyrus, O.

SAND SIFTERS.
Arcade Mfg. Co., Freeport, Ill.
Blystone Mfg. Co., Cambridge Springs, Pa.
Dunning, W. D., Syracuse, N. Y.
Standard Sand & Machine Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

SASH (Steel Casement).
Trussed Concrete Steel Co., Detroit, Mich.

SAW ARBORS.
Camden Forg Co., Camden, N. J.

SAWS (Cold and Hot Metal).
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Espen-Lucas Mch. Works, Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburgh, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N. Y.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Newton Mach. Tool Works, Inc., Philadelphia.
Peerless Machine Co., Racine, Wis.
Q. M. S. Company, The, Chicago, Ill.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SAW SHARPENING MACHINERY.
Disston, Henry, & Sons, Inc., Philadelphia, Pa.

SCALES.
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES, CARS AND BOXES.
Lakewood Engrg. Co., Cleveland, O.

SCRAP RECLAIMING EQUIPMENT.
Southwark Foundry & Mach. Co., Philadelphia.

SCREENS AND SIEVES.
Erdle Perforating Co., Rochester, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Company, Chicago, Ill.
Standard Scale & Supply Co., Pittsburgh, Pa.

SCREENS (Coal and Sand).
Erdle Perforating Co., Rochester, N. Y.
Link-Belt Company, Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
Wright Wire Co., Worcester, Mass.

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FORGINGS

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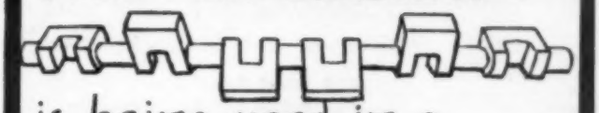

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Open Hearth and Electric Furnace Steel.

PLAIN HEAVY FORGINGS

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SCREENS (Pulsating and Revolving).

Link-Belt Company, Chicago, Ill.

SCREENS (Water Intake).

Link-Belt Company, Chicago, Ill.

SCREW MACHINE PRODUCTS.

Automatic Products Co., Detroit, Mich.
Barnes, Wallace, Co., The, Bristol, Conn.
Corbin Screw Corporation, New Britain, Conn.
Ohmer Fare Register Co., Dayton, O.
St. Louis Screw Co., St. Louis, Mo.
Standard Screw Products Co., Detroit, Mich.

SCREW MACHINES.

Acme Machine Tool Co., Cincinnati, O.
Oliver Machinery Co., Grand Rapids, Mich.
Warner & Swasey Co., Cleveland, O.

SCREWS.

Clark Bros. Bolt Co., Milldale, Conn.
Corbin Screw Corporation, New Britain, Ct.
Milton Mfg. Co., Milton, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SCREWS (Cap and Set).

Automatic Products Co., Detroit, Mich.
St. Louis Screw Co., St. Louis, Mo.

SCREW STOCK (Free Cutting).

Columbia Steel & Shafting Co., Pittsburgh, Pa.

SCREW STOCK (Iron).

Westerman & Co., Lockport, N. Y.

SECOND HAND MACHINERY.

Baird Machy. Co., Pittsburgh, Pa.
Biggs-Watterson Co., Cleveland, O.
Carrell, W. A., & Co., Pittsburgh, Pa.
Graves Machinery Exchange, New York City.
Harris Bros. Co., Chicago, Ill.
Manhattan Machinery Exchange, New York.
McCoy & Brandt Machy. Co., Pittsburgh, Pa.
Mitchell-Tappen Co., New York, N. Y.
Mitshkum Co., M., Detroit, Mich.
Modern Machinery Exchange, New York.
Niles-Bement-Pond Co., New York, N. Y.
Russell Machine Co., Pittsburgh.
Ryerson, Jos. T., & Son, Chicago, Ill.
Service Supply & Equip. Co., Pittsburgh, Pa.
Strong & Hery Co., Rochester, N. Y.
Zelnicker, Walter A., Supply Co., St. Louis, Mo.

SEMI STEEL.

McLain's System, Inc., Milwaukee, Wis.

SET AND CAP SCREW IRON.

Westerman & Co., Lockport, N. Y.

SHAFT HANGERS.

New Departure Mfg. Co., Bristol, Conn.

SHAFTING.

American Vanadium Co., The, Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem. Pa.
Bourne-Fuller Co., The, Cleveland, O.
Camden Forge Co., Camden, N. J.
Cincinnati Iron & Steel Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
Ward's, Edgar T., Sons, Boston, Mass.

SHAPERS.

Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

SHAPES (Iron and Steel).

American Vanadium Co. The, Pittsburgh, Pa.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Empire Art Metal Co., Inc., College Pt., N. Y.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Moltrup Steel Products Co., Beaver Falls, Pa.
Phoenix Iron Co., Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

SHAPES (Special, Hollow Metal).

Empire Art Metal Co., Inc., College Pt., N. Y.

SHEAR BLADES AND KNIVES.

Heppenstall Forge & Knife Co., Pittsburgh.
Tinker, F., & Sons Co., Pittsburgh, Pa.
White, L. & I. J., Co., Buffalo, N. Y.

SHEARS.

Bliss, E. W., Co., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Garrison, A., Foundry Co., Pittsburgh, P.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
Tod, Wm., Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

SHEET BARS.

Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Mudge, Edmund W., & Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

SHEET METAL WORKING MACHINERY.

National Roll & Foundry Co., Avonmore, Pa.

SHEET MILL EQUIPMENT.

Treadwell Engineering Co., Easton, Pa.

SHEETS.

Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Mansfield Sheet & Tin Plate Co., Mansfield, O.
Nagel Steel Co., Pottstown, Pa.
Newport Rolling Mill Co., Newport, Ky.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Watson Bros. Co., New Castle, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown O.

SHEETS (Black).

American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Mansfield Sh't & Tin Plate Co., Mansfield, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Wheeling Steel & Iron Co., Wheeling, W. Va.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Blue Annealed).

American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Brass and Copper).

Gardner, B. M., Company, Cleveland, O.

SHEETS (Cold Rolled).

Bourne-Fuller Co., The, Cleveland, O.
Inland Steel Co., Chicago, Ill.
Stark Rolling Mill Co., Canton, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Corrugated).

American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rilling Mill Co., Newport, Ky.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Dead Soft).

American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Mansfield Sh't & Tin Plate Co., Mansfield, O.
Newport Rolling Mill Co., Newport, Ky.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Ward's, Edgar T., Sons, Boston, Mass.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Galvanized).

Allegheny Steel Co., Pittsburgh, Pa.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Newport Rolling Mill Co., Newport, Ky.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth, Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

SHEETS (Long Terne).

Canton Sheet Steel Co., Canton, O.

SHEETS (Nickel).

Newport Rolling Mill Co., Newport, Ky.

SHEETS (Perforated).

Erdle Perforating Co., Rochester, N. Y.

SHEETS (Polishing and Planished).

American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.
Mansfield Sh't & Tin Plate Co., Mansfield, O.

SHEETS (Roofing). (See Roofing and Siding).

SHEET IRON WORK.

Hendrick Mfg. Co., Carbondale, Pa.

SHEET METAL WORKING MACHINERY.

Bliss, E. W., Co., Brooklyn, N. Y.

SHELVING (Steel).

Empire Art Metal Co., Inc., College Pt., N. Y.
New Britain Mach. Co., New Britain, Conn.

SHINGLES (Galvanized and Terne Painted).

Canton Sheet Steel Co., Canton, O.

SHOP BOXES AND CANS.

New Britain Machine Co., New Britain, Conn.

SIGNS (Metal).

Beecher-Fowler Mfg. Co., Louisville, Ky.

SKIM GATES.

Erdle Perforating Co., Rochester, N. Y.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

FORGINGS

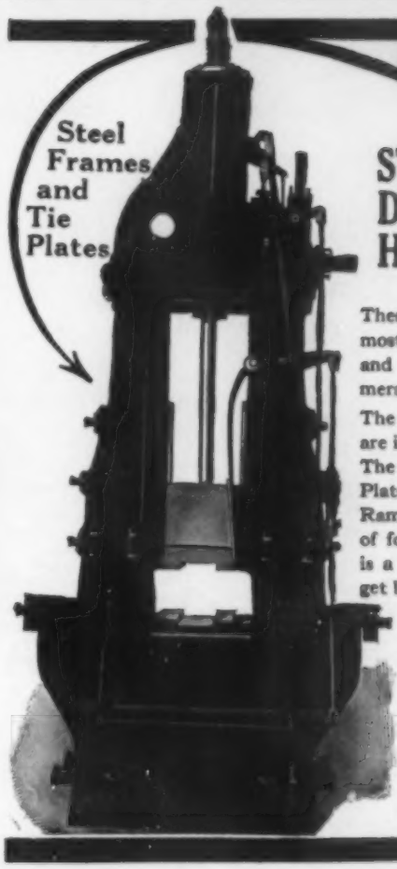
FORGINGS

DROP, HEADING-MACHINE AND STEAM HAMMER FORGINGS

THE CHAMPION MACHINE AND FORGING CO.
CLEVELAND, O. "Sixth City"
New York, 30 Church St.—Chicago: Railway Exchange Bldg.
Philadelphia Bourse Bldg.—Detroit, H.B. Kendal 56 Cadillac Sq.

ERIE

Steel Frames and Tie Plates



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Erie Penn'a.

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ROCKFORD DROP FORGE CO.
ROCKFORD, ILLINOIS

GENERAL DROP FORGE CO.
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SEND US PRINTS OR MODELS FOR PRICES
BUFFALO, N. Y.

The Drop Forging Company
Automobile Forgings
Forgings for fine tool and machine work
of New York
Jersey City, N. J.

BOOKS

We can fill your order for any book in print on any subject.
Tell us your needs and we will be glad to recommend the best books for your purpose.

Penton's Book News
Penton Building CLEVELAND, OHIO
515

The Rolling Mill Industry
By F. H. KINDL

¶ A condensed, practical description of American rolling mill practice.
¶ Twenty-seven charts and illustrations.
¶ Tables of production of all rolling mill products in the United States.

Cloth Binding - $2.00
Leather Binding - $3.00
Postpaid

Penton's Book News
Penton Bldg., Cleveland, Ohio
507

SLABS.

American Steel Export Co., New York City.
Andrews Steel Co., Newport, Ky.
Federal Export Corporation, New York City.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Mudge, Edmund W., & Co., Pittsburgh, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sh't & Tube Co., Youngstown, O.

SLEEVES AND NOZZLES.

Manown Mfg. Co., Pittsburgh, Pa.

SLITTING CUTTERS (Circular).

Tinker, F., & Sons Co., Pittsburgh, Pa.

SOCKETS (Drill).

Clark Equipment Co., Buchanan, Mich.

SPELTER.

Amer. Zinc, Lead & Smelt'g Co., New York.

SPIKES.

American Steel & Wire Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Larkin, J. K., & Co., New York City.
Republic Iron & Steel Co., Youngstown, O.

SPINDLES (Forging).

Crucible Steel Forge Co, Cleveland, O.

SPOKE WIRE FOR WIRE WHEELS.

American Steel & Wire Co., Chicago, Ill.

SPRING COILING MACHINERY.

Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS.

American Steel & Wire Co., Chicago, Ill.
American Vanadium Co., Pittsburgh, Pa.
Barnes, Wallace Co., The, Bristol, Conn.
Duer Spring & Mfg. Co., Pittsburgh, Pa.
Raymond Mfg. Co., Corry, Pa.

SPROCKET AND TRACTION WHEELS.

Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.

SQUEEZER MOLDING MACHINES.

Pridmore, Henry E., Chicago, Ill.

SQUEEZERS (Power).

Pridmore, Henry E., Chicago, Ill.

STACKS (Steel).

American Bridge Co., New York, N. Y.
Lindsay, W. W., Co., Philadelphia, Pa.
Phoenix Iron Works Co., Meadville, Pa.

STAMPINGS (Sheet Metal).

American Tube & Stamping Co., Bridgeport, Conn.
Bettcher Mfg. Co., Cleveland, O.
Blodgett Engrg. & Tool Co., Detroit, Mich.
Bossert Corporation, The, Utica, N. Y.
Burr Mfg. Co., Cleveland, O.
Conway Stove Co., Bellevue, O.
Empire Art Metal Co., Inc., College Pt., N. Y.
Erdle Perforating Co., Rochester, N. Y.
Fouts, C. C., Company, Middletown, O.
Gem Mfg. Co., Pittsburgh, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Lansing Stamping & Tool Co., Lansing, Mich.
New Britain Mch. Co., New Britain, Conn.
Wisconsin Metal Products Co., Racine, Wis.
Worcester Stamped Metal Co., Worcester, Mass.

STAMPINGS (Steel).

American Tube & Stamping Co., Bridgeport, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McCord & Co., Chicago, Ill.

STAMPS (Steel).

Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pannier Brothers Stamp Co., Pittsburgh, Pa.
Pittsburgh Steel Stamp Co., Pittsburgh, Pa.

STAMP HOLDERS (Steel).

Pannier Bros. Stamp Co., Pittsburgh, Pa.

STAMP SHOES AND DIES.

Midvale Steel Co., Philadelphia, Pa.

STAPLES.

American Steel & Wire Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Youngstown Sh't & Tube Co., Youngstown, O.

STARS (Hard Iron).

Fanner Mfg. Co., Cleveland, O.

STARTERS (Electric Motor).

Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STEAM TRAPS.

National Tube Co., Pittsburgh, Pa.

STEEL.

American Bridge Co., New York, N. Y.
American Vanadium Co., Pittsburgh, Pa.
Andrews Steel Co., Newport, Ky.
Beals & Company, Buffalo, N. Y.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Century Steel Co. of America, New York.
Chicago Metal Treating Co., Chicago, Ill.
Cincinnati Steel Castings Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh.
Disston, Henry, Sons, Inc., Philadelphia, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Kidd Drawn Steel Co., Aliquippa, Pa.
La Belle Iron Works, Steubenville, O.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Nagel Steel Co., Pottstown, Pa.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Standard Alloys Co., Pittsburgh, Pa.
Superior Steel Corp., Pittsburgh.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
West Leechburg Steel Co., Pittsburgh, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wickwire Steel Co., Buffalo, N. Y.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

STEEL (Alloy).

American Vanadium Co., Pittsburgh, Pa.
Andrews Steel Co., Newport, Ky.
Central Steel Co., The, Massillon, O.
Century Steel Co. of America, New York.
Cincinnati Steel Castings Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Crowley, John A., Co., New York City.
Latrobe Electric Steel Co., Latrobe, Pa.
Midvale Steel Co., Philadelphia, Pa.
Ohio Seamless Steel Tube Co., Shelby, O.
Standard Alloys Co., Pittsburgh, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Alloys Steel Corp., The, Canton, O.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

STEEL (Alloy, Stellite).

Haynes Stellite Co., The, Kokomo, Ind.

STEEL (Carbon).

Century Steel Co. of America, New York.

STEEL (Cold Drawn).

Barnes, Wallace, Co., The, Bristol. Conn.
Bourne-Fuller Co., The, Cleveland, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Kidd Drawn Steel Co., Aliquippa, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Ohio Seamless Tube Co., The, Shelby, O.
Peerless Drawn Steel Co., Massillon, O.
Pittsburgh Cold Rolled Steel Co., Pittsburgh.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Superior Steel Corp., Pittsburgh.
Superior Steel & Iron Co., New York City.
Union Drawn Steel Co., Beaver Falls, Pa.
United Alloys Steel Corp., The, Canton, O.
West Leechburg Steel Co., Pittsburgh, Pa.

STEEL (Die).

Columbia Steel & Shafting Co., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.

STEEL (Electric Furnace).

Bethlehem Steel Co., The, So. Bethlehem, Pa.
Buckeye Steel Castings Co., Columbus, O.
Connecticut Electric Steel Co., Inc., Hartford, Conn.
Crowley, John A., Co., New York City.
Illinois Steel Co., Chicago, Ill.
Lartrobe Electric Steel Co., Latrobe, Pa.
Union Electric Steel Co., Pittsburgh, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL (High Speed).

Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Century Steel Co. of America, New York.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Midvale Steel Co., Philadelphia, Pa.
Onondaga Steel Co., Syracuse, N. Y.
Standard Alloys Co., Pittsburgh, Pa.
Superior Steel & Iron Co., New York City.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Ward's, Edgar T., Sons, Boston, Mass.

STEEL (High Speed, Stellite).

Haynes Stellite Co., The, Kokomo, Ind.

STEEL (Open Hearth).

Andrews Steel Co., Newport, Ky.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Saft'g Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Nagel Steel Co., Pottstown, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL (Spring).

Firth-Sterling Steel Co., McKeesport, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL, STRIP (Hot and Cold Rolled).

American Tube & Stamping Co., Bridgeport, Conn.
Superior Steel Corp., Pittsburgh.
West Leechburg Steel Co., Pittsburgh, Pa.

STEEL (Structural).

Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Blaw Steel Construction Co., Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Chesapeake Iron Works, Baltimore, Md.
Cincinnati Iron & Steel Co., Cincinnati, O.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Empire Art Metal Co., Inc., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co. Pittsburgh, Pa.
Kratzer, W. N., Co., Pittsburgh.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Newton Falls Construction Co., Newton Falls, O.
Niles Forge & Mfg. Co., The, Niles, O.
Phoenix Iron Co., The, Philadelphia, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL (Tool).

American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Century Steel Co. of America, New York.
Cincinnati Iron & Steel Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
McInnes Steel Co., Corry, Pa.
Midvale Steel Co., Philadelphia, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Standard Alloys Co., Pittsburgh, Pa.
Superior Steel & Iron Co., New York City.
United Alloy Steel Corporation, Canton, O.
Vanadium-Alloys Steel Co., Pittsburgh, Pa.
Ward's, Edgar T., Sons, Boston, Mass.

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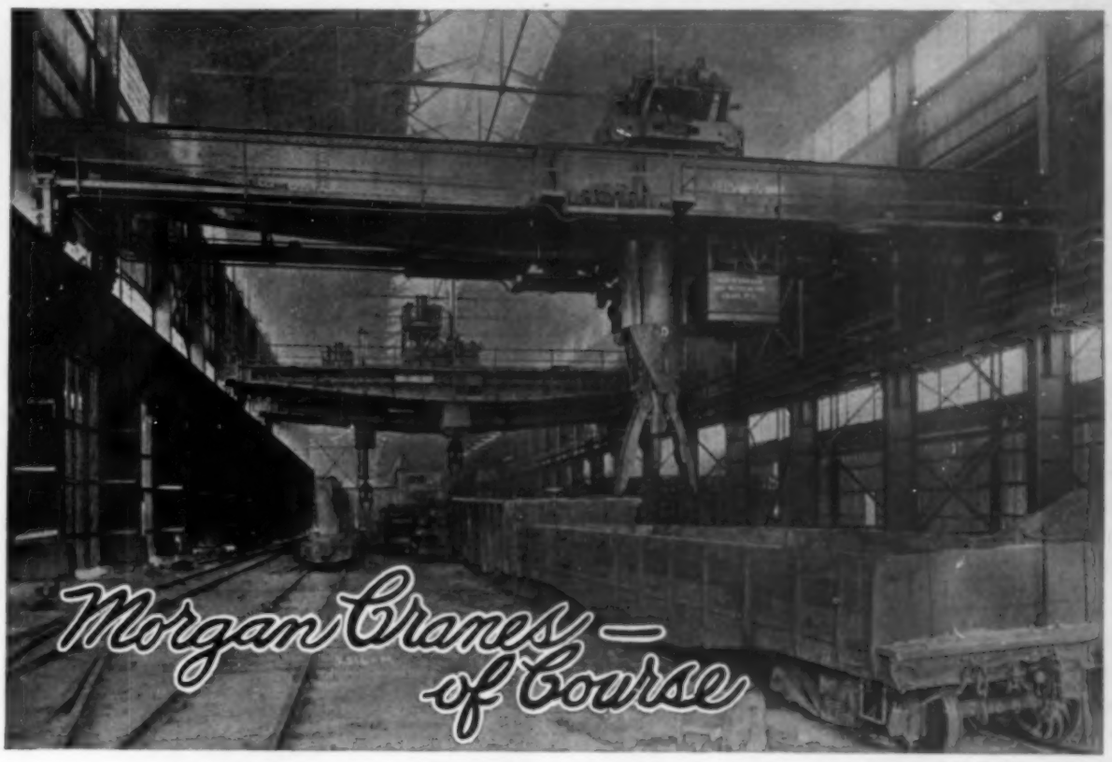

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Morgan Rack Type
Soaking Pit Cranes

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Alliance, Ohio. U.S.A.

NEW YORK
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M. Mett & Co.
LONDON
PARIS

STEEL (Tool, Stellite).

Haynes Stellite Co., The, Kokomo, Ind.

STEEL (Tungsten).

Century Steel Co. of America, New York.

STEEL PLANT CONSTRUCTION.

Arnold Co., The, Chicago, Ill
Lindsay, W. W., Co., Philadelphia, Pa.

STEEL PLATE CONSTRUCTION.

Camden Boiler Works, Inc., Camden, N. J.
Colonial Iron Works Co., Cleveland, O.
Knox Pressed & Welded Steel Co., Pittsburgh.
Lindsay, W. W., Co., Philadelphia, Pa.
Pennsylvania Engrg. Works, New Castle, Pa.

STEEL STRUCTURAL WORK.

Arnold Co., The, Chicago, Ill.
Eichleay, John Jr., Co., Pittsburgh, Pa.
Lindsay, W. W., Co., Philadelphia, Pa.

STELLITE.

Haynes Stellite Co., The, Kokomo, Ind.

STENCILS (Brass and Rubber).

Matthews, Jas. H., & Co., Pittsburgh, Pa.

STILLS (Cast Iron).

Buffalo Foundry & Mach. Co., Buffalo, N. Y.

STOKERS.

Babcock & Wilcox Co., The, New York City.
Erie Foundry Co., Erie, Pa.
Green Engineering Co., Chicago, Ill.
Hagan, Geo. J., Co., Pittsburgh, Pa.

STOOLS (Steel).

Angle Steel Stool Co., Otsego, Mich.

STOVE TRIMMINGS.

Fanner Mfg. Co., Cleveland, O.

STRAIGHTENING MACHINERY.

Abramsen Engineering Co., Pittsburgh, Pa.

STRAPS (Connecting).

Bay City Forge Co., Erie, Pa.

STRAPS (Rod).

Camden Forge Co., Camden, N. J.

SULPHURIC ACID.

Amer. Zinc, Lead & Smelt'g Co., New York.

SULPHATE OF IRON.

American Steel & Wire Co., Chicago, Ill.

SWITCHBOARDS.

Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES (Electric).

Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

SWITCH STANDS.

Bethlehem Steel Co., The, So. Bethlehem, Pa.

SYNDOLAG.

Davison, Allen S., Co., Pittsburgh, Pa.

TACKS.

American Steel & Wire Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.

TANKS.

Air Tight Steel Tank Co., Pittsburgh, Pa.
American Bridge Co., New York, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hauser-Standard Tank Co., The, Cincinnati, O.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

TANKS (Acetylene).

Linde Air Products Co., New York, N. Y.
National Tube Co., Pittsburgh, Pa.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

TANKS (Gasoline and Oil Storage).

Air Tight Steel Tank Co., Pittsburgh, Pa.

TANKS (Pressure).

Air Tight Steel Tank Co., Pittsburgh, Pa.

TANKS (Wooden).

Hauser-Stander Tank Co., Cincinnati, O.

TAR EXTRACTORS.

Smith Gas Engrg. Co., The, Lexington, O.

THREAD CUTTING TOOLS.

Landis Machine Co., Waynesboro, Pa.

TILE (Fire Clay).

Trussed Concrete Steel Co., Detroit, Mich.
Union Mining Co., Mt. Savage, Md.

TINNED WIRE (Equipment).

Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

TIN PLATE.

American Sheet & Tin Plate Co., Pittsburgh.
American Steel Export Co., New York City.
Federal Export Corporation, New York City.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Tin Plate Co. Canonsburg, Pa.
Taylor, N. & G., Co., Inc., Philadelphia, Pa.
Trumbull Steel Co., The, Warren, O.
Wheeling Steel & Iron Co., Wheeling, W. Va.

TIN PLATE MILL EQUIPMENT.

Birdsboro Steel Foundry & Machine Co.,
Birdsboro, Pa.
National Roll & Fdy. Co., Avonmore, Pa.
Treadwell Engineering Co., Easton, Pa.
United Eng. & Fdy. Co., Pittsburgh, Pa.

TIRES (Locomotive and Car Wheel).

American Vanadium Co., The, Pittsburgh, Pa.
Midvale Steel Co., The, Philadelphia, Pa.

TITANIUM.

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TOE CALK (Steel).

American Steel & Wire Co., Chicago, Ill.

TOOL HOLDER BITS (Treated).

Vanadium-Alloys Steel Co., Pittsburgh, Pa.

TOOL HOLDERS.

Clark Equipment Co., Buchanan, Mich.
Williams, J. H., & Co., Brooklyn, N. Y.

TOOLS.

Billings & Spencer Co., The, Hartford, Conn.
Cleveland Pneumatic Tool Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Haynes Stellite Co., The, Kokomo, Ind.
Lansing Stamping & Tool Co., Lansing, Mich.
Ohmer Fare Register Co., Dayton, O.
Oldham, Geo., & Sons Co.,
Frankford, Philadelphia, Pa.
Parker Machine Co. Boston, Mass.
Ryerson, Jos. T., & Son, Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
White, L. & I. J., Co., Buffalo, N. Y.

TOOLS (Special).

Cleveland Milling Machine Co., Cleveland, O.

TORCHES (Acetylene, Blow, Oxy-acetylene).

Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

TORCHES (Foundry).

Mahr Mfg. Co., Minneapolis, Minn.

TRACK AND RAIL SUPPLIES.

American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Chase Foundry & Mfg. Co., Columbus, O.
Federal Export Corporation, New York City.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Lackawanna Steel Co., Buffalo, N. Y.
Lakewood Engineering Co., Cleveland, O.
Larkin, J. K., & Co., New York City.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

TRAMRAILS (Overhead Systems).

Brown Hoisting Machinery Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRAMWAYS.

Link-Belt Company, Chicago, Ill.

TRAMWAYS (Wire Rope).

American Steel & Wire Co., Chicago, Ill.

TRANSFORMERS.

General Electric Co., Schenectady, N. Y.

TRANSMISSION CHAINS.

Link-Belt Company, Chicago, Ill.

TROLLEYS.

Browning Co., Cleveland, O.
Cleveland Crane & Engrg. Co., Wickliffe, O.
O. M. S. Company, The, Chicago, Ill.
Shepard Electric Crane & Hoist Co.,
Montour Falls, N. Y.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS (Foundry).

Lakewood Engineering Co., Cleveland, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

TRUCKS (Industrial).

Angle Steel Stool Co., Otsego, Mich.
Atlas Car & Mfg. Co., Cleveland, O.
Lakewood Engr. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS (Motor).

Federal Motor Truck Co., Detroit, Mich.

TRUCKS (Wire Mill).

Lakewood Engineering Co., Cleveland, O.
Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

TRUCKS (Small, Hand).

Angle Steel Stool Co., Otsego, Mich.
Lakewood Engineering Co., Cleveland, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

TUBE MILL MACHINERY.

Standard Engrg. Co., Ellwood City, Pa.

TUBES.

Allegheny Steel Co., The, Pittsburgh, Pa.
American Steel Export Co., New York City.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Detroit Seamless Steel Tube Co., Detroit, Mich.
Empire Art Metal Co., Inc., College Pt., N. Y.
Federal Export Corporation, New York City.
La Belle Iron Works, Steubenville, O.
National Tube Co., Pittsburgh, Pa.
Ohio Seamless Tube Co., The, Shelby, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Ward's, Edgar T., Sons, Boston, Mass.
Wheeling Steel & Iron Co., Wheeling, W. Va.
Worth Brothers Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

TUBES (Seamless Brazed Brass and Copper).

Gardner, B. M., Co., The, Cleveland, O.

TUBS (Wire Mill Cleaning House).

Turner, Vaughn & Taylor Co.,
Cuyahoga Falls, O.

TUMBLING MILLS.

Whiting Fdy. Equipment Co., Harvey, Ill.

TUNGSTEN ORE.

Vasce Mining Company, Boulder, Colo.

TURBINES (Steam).

General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.,
East Pittsburgh, Pa.

TURBINE SHAFTS.

Camden Forge Co., Camden, N. J.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

The
ALLIANCE MACHINE COMPANY

ALLIANCE, OHIO

PITTSBURGH BIRMINGHAM

A Special Alliance Crane

The crane illustrated on this page is a *Ten-Ton Special Gantry Crane,* Four-Motor Type, 46-foot Span, with 24-foot and 25-foot Cantilever Extensions. The Cage is attached to the trolley from where the operator controls the Ingot and Bloom Handling Tongs shown. Trolley also provided with magnet Hoist.

Our successes of the past are but a prophesy of the higher achievements we have set for the future.

TURNBUCKLES.

American Bridge Co., New York, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Merrill Brothers, Maspeth, N. Y.
Michigan Bolt & Nut Works, Detroit, Mich.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

TURNING.

Van Dorn & Dutton Co., Cleveland, O.

TURNTABLES.

American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Lakewood Engrg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

UNION COUPLINGS (Cold Drawn Steel).

Mark Mfg. Co., Evanston, Ill.

UNIONS (Pipe).

Dart, E. M., Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.

URANIUM.

Standard Alloys Co., Pittsburgh, Pa.

VALVE LEATHERS.

Graton & Knight Mfg. Co., Worcester, Mass.
Scully Steel & Iron Co., Chicago, Ill.

VALVES AND FITTINGS.

Chambersburg Engrg. Co., Chambersburg, Pa.
Connersville Blower Co., The, Connersville, Ind.
Dayton Steel Foundry Co., Dayton, O.
Homestead Valve Mfg. Co., Pittsburgh, Pa.
Larkin, J. K., & Co., New York City.
Lunkenheimer Co., The, Cincinnati, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

VALVES (Gas).

Velte Foundry & Machine Co., Mars, Pa.

VANADIUM.

American Vanadium Co., Pittsburgh, Pa.
Standard Alloys Co., Pittsburgh, Pa.

VATS (Acid and Chemical).

Hauser-Stander Tank Co., The, Cincinnati, O.

VISES.

Williams, J. H., & Co., Brooklyn, N. Y.

WASHED METAL.

Brier Hill Steel Co., Youngstown, O.

WASHER CUTTING MACHINES.

Southwark Foundry & Mach. Co., Philadelphia.

WASHERS (Cast).

Larkin, J. K., & Co., New York City.

WASHERS (Iron and Steel).

Bayonne Bolt & Nut Co., Bayonne, N. J.
Bettcher Mfg. Co., Cleveland, O.
Bourne-Fuller Co., The, Cleveland, O.
Interstate Iron & Steel Co., Chicago, Ill.
Larkin, J. K., & Co., New York City.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WASHERS (Leather).

Graton & Knight Mfg. Co., The, Worcester, Mass.

WASHING MATERIAL (Rags).

Ford, J. B., Co., Wyandotte, Mich.

WATER CINDER MILLS.

Whiting Foundry Equipment Co., Harvey, Ill.

WATER COOLED STANDING (For Sheet and Tin Mills).

National Roll & Foundry Co. Avonmore, Pa.

WELDED PRODUCTS (Electric).

Standard Screw Products Co., Detroit, Mich.

WELDED STEEL PLATE CONSTRUCTION.

Knox Pressed & Welded Steel Co., Pittsburgh.

WELDING (Custom).

Burr Mfg. Co., Cleveland, O.
K. & G. Welding & Cutting Co., New York.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

WELDING (Oxy-Acetylene Process).

Fouts, C. C., Company, Middletown, O.
Knox Pressed & Welded Steel Co., Pittsburgh.
Modern Engrg. Co., St. Louis, Mo.

WELDED AND CUTTING APPARATUS (Electric).

General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING APPARTUS (Oxy-Acetylene Process).

K. & G. Welding & Cutting Co., New York.
Linde Air Products Co., New York, N. Y.
Modern Engrg. Co., St. Louis, Mo.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

WET PANS.

American Clay Machinery Co., Bucyrus, O.

WHEELBARROWS.

Lakewood Engrg. Co., Cleveland, O.

WHEELS.

Treadwell Engineering Co., Easton, Pa.

WHEELS (Car and Locomotive).

American Steel Export Co. New York City.
American Steel Foundries, Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.
Federal Export Corporation, New York City.
Midvale Steel Co., Philadelphia, Pa.
National Malleable Castings Co., Cleveland, O.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.

WHEELS (Rope).

Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.

WHEELS (Steel Tired).

Midvale Steel Co., Philadelphia, Pa.

WHEELS (Steel Truck).

Dayton Steel Foundry Co., Dayton, O.

WINDER, LINK (Coil Chain).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE.

Roebling's Sons Co., John A., Trenton, N. J.

WIRE (Barb and Fence).

American Steel & Wire Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE (Broom).

American Steel & Wire Co., Chicago, Ill.

WIRE (Enameled Magnet).

American Steel & Wire Co., Chicago, Ill.

WIRE (Fence).

American Steel & Wire Co., Chicago, Ill.
Interstate Iron & Steel Co., Chicago, Ill.

WIRE (Fence, Woven).

American Steel & Wire Co., Chicago, Ill.

WIRE (Fine).

American Steel & Wire Co., Chicago, Ill.

WIRE (Flat and Round).

American Steel & Wire Co., Chicago, Ill.

WIRE (Flat, High or Low Carbon).

American Steel & Wire Co., Chicago, Ill.

WIRE (Ignition).

American Steel & Wire Co., Chicago, Ill.

WIRE (Lath).

Wright Wire Co., Worcester, Mass.

WIRE (Mattress).

American Steel & Wire Co., Chicago, Ill.

WIRE (Piano and Music).

American Steel & Wire Co., Chicago, Ill.

WIRE (Pipe Organ).

American Steel & Wire Co., Chicago, Ill.

WIRE (Rubber Covered).

American Steel & Wire Co., Chicago, Ill.

WIRE (Screw Driver).

American Steel & Wire Co., Chicago, Ill.

WIRE (Telephone and Telegraph).

American Steel & Wire Co., Chicago, Ill.

WIRE (Threaded).

Progressive Mfg. Co., Torrington, Conn.

WIRE (Vanadium).

American Vanadium Co., Pittsburgh, Pa.

WIRE (Weaving).

American Steel & Wire Co., Chicago, Ill.

WIRE AND CABLES (Electric).

American Steel & Wire Co., Chicago, Ill.

WIRE CLOTH.

Wright Wire Co., Worcester, Mass.

WIRE COILING MACHINERY.

Sleeper & Hartley, Inc., Worcester, Mass.

WIRE FENCE.

Wright Wire Co., Worcester, Mass.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE GRILLS (Window, Machinery, Tool Room).

Wright Wire Co., Worcester, Mass.

WIRE GUARDS.

Wright Wire Co., Worcester, Mass.

WIRE MILL MACHINERY.

Blake & Johnson Co., Waterbury, Conn.
Kilby Mfg. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

WIRE MILL MACHINERY (Equipment Complete).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE NAIL MACHINERY.

Sleeper & Hartley, Inc., Worcester, Mass.

WIRE NAIL MACHINERY (Equipment Complete).

Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE RODS (Steel).

American Steel & Wire Co., Chicago, Ill.

WIRE ROPE.

Roebling's Sons Co., John A., Trenton, N. J.

WIRE ROPE AND FITTINGS.

American Steel & Wire Co., Chicago, Ill.
Williamsport Wire Rope Co., Williamsport, Pa.
Wright Wire Co., Worcester, Mass.

WIRE STRAIGHTENING AND CUTTING MACHINES.

Sleeper & Hartley, Inc., Worcester, Mass.

WIRE, WIRE RODS AND WIRE PRODUCTS.

American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Wickwire Steel Co., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WOODEN TANKS.

Hauser-Stander Tank Co., The, Cincinnati, O.

WOODWORKING MACHINERY.

Oliver Machinery Co., Grand Rapids, Mich.

WRENCHES.

Williams, J. H., & Co., Brooklyn, N. Y.

WRENCHES (Pipe).

Drop Forging Co. of N. Y., Jersey City, N. J.

WRENCHES (Reversible).

Lowell Wrench Co., Worcester, Mass.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

85 Ton—5 Ton Auxiliary Power House Crane
Ask for Photos and Preliminary Specifications

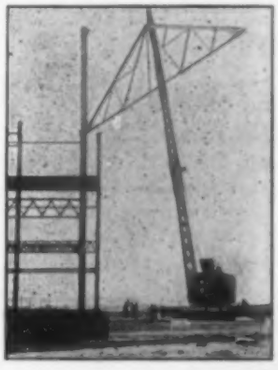
THE CLEVELAND CRANE
& ENGINEERING CO. WICKLIFFE, O.

50 Church St., New York
First National Bank Bldg., Pittsburg

CRANES For All Purposes Electric and Hand Power

CASE STANDARD CRANES are the result of thoroughly tested ideas secured during many years from the best designing and operating engineers. They are manufactured under the most favorable conditions in a plant recently equipped at a large expense for this particular purpose. They represent the greatest value for price charged.

THE CASE CRANE & ENGINEERING CO.
COLUMBUS, OHIO



Dependable cranes for steel erecting.

INDUSTRIAL WORKS CRANES
are undoubtedly the standard for this work.

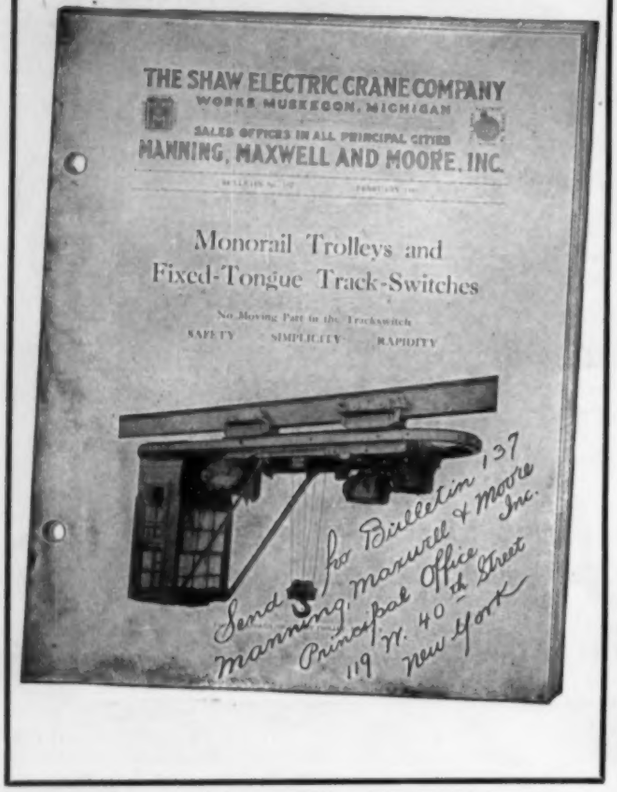
INDUSTRIAL WORKS
Bay City, MICH.

NILES CRANES

2 TO 200 TONS CAPACITY

Ask for Catalogue

NILES-BEMENT-POND CO., 111 Broadway, New York
Boston Philadelphia Birmingham Pittsburgh Cincinnati Cleveland Detroit Chicago St. Louis San Francisco



ELECTRIC
EUCLID
HOISTS

Euclid Hoists are Built for Service

The main casting of Euclid Hoists, carrying all the machinery, is made in one piece, assuring perfect alignment of shafts and freedom from vibration, thus materially lengthening the life of the hoist.

The simple and efficient construction of the Euclid Hoist brake makes the use of an electric brake unnecessary except in rare cases. This is made possible by a novel, patented arrangement. Write for catalog and learn all about this superior hoist.

The Euclid Crane & Hoist Co.
Dept. B. EUCLID, O.

O. S. LOCOMOTIVE CRANES

One O. S. Locomotive Crane will take the place of many men, and the work that would have taken the men days, is accomplished in minutes.

Our free catalogs illustrate the various uses of O. S. Locomotive Cranes. Let us send you one.

Write us immediately

Orton & Steinbrenner Co.
Chicago, Ill.
Shops, Huntington, Ind.

Simplicity Accessibility Interchangeability

CHAMPION
ELECTRIC TRAVELING CRANES
General Sales Office:
THE BIGGS-WATTERSON COMPANY
Cleveland, Ohio

Accessible—Self-oiling—All Gears Enclosed.

THE MILWAUKEE CRANE

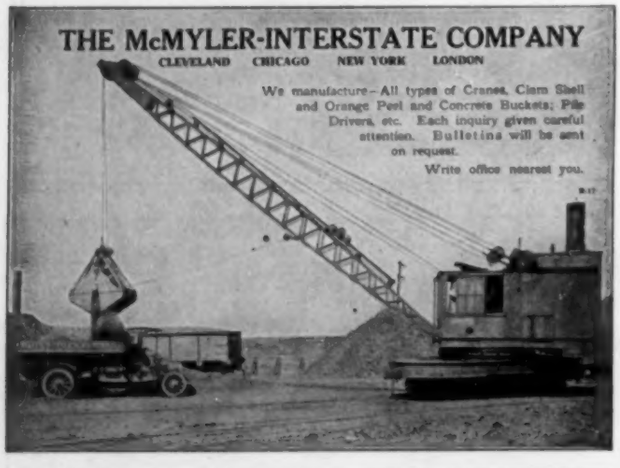
Prompt Delivery—Inquiries Solicited

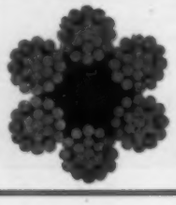
Milwaukee Electric Crane & Mfg. Co.
INCORPORATED. MILWAUKEE, WIS.

THE McMYLER-INTERSTATE COMPANY
CLEVELAND CHICAGO NEW YORK LONDON

We manufacture—All types of Cranes, Clam Shell and Orange Peel and Concrete Buckets; Pile Drivers, etc. Each inquiry given careful attention. Bulletins will be sent on request.

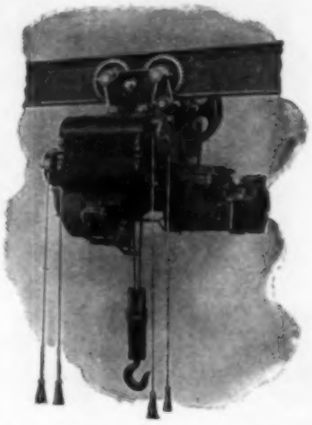
Write office nearest you.





ROEBLING
WIRE ROPE
WIRE ROPE FITTINGS
JOHN A. ROEBLING'S SONS CO.
Trenton, New Jersey

BROWNING
LOCOMOTIVE CRANES
THE BROWNING COMPANY, CLEVELAND
SALES OFFICES: NEW YORK, CHICAGO, PHILADELPHIA, SAN FRANCISCO



"P & H" HOISTS

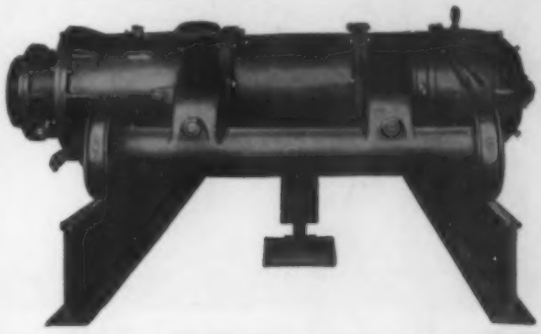
solve the "shop to shipping platform" problem

We can give you definite facts and data on savings that can be effected

CAPACITY:—½ to 6 TONS

Write for Bulletin 301-B, and ask our service department for information

Pawling & Harnischfeger Co.
Milwaukee, Wis.



Shepard Crane Trolley

The Shepard Standard Type Crane Trolley above illustrated, provides bath lubrication, complete dirt exclusion and permanent alignment of the gearing breaks and motor.

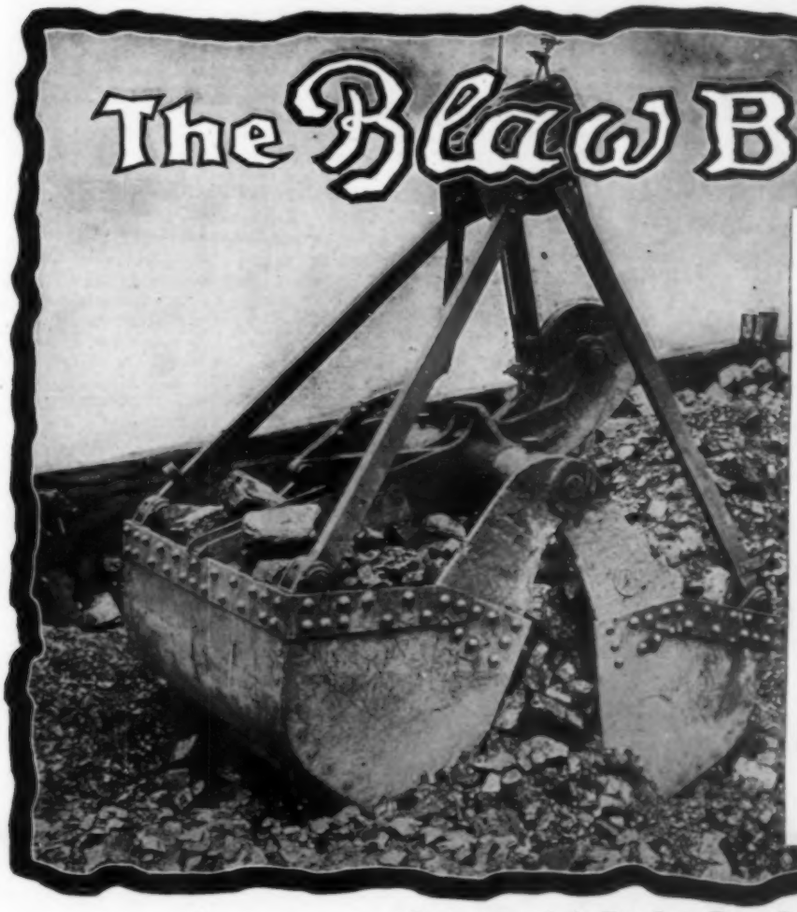
The Shepard Line specializes on fully developed cranes of the highest quality in capacities of from 1 to 30 tons.

If you are figuring on installing cranes or hoists, look into the Shepard Line.

Write at once for Shepard Folder S

SHEPARD
ELECTRIC CRANE & HOIST CO.
MONTOUR FALLS NY

The Blaw Bucket



Every "BLAW" Bucket is built with a rugged strength that keeps it "on the job."

Added to the economy secured by its speed in digging and rehandling materials, there is the *big saving due to low maintenance costs.*

The "BLAW" Bucket is designed to save LABOR, the cost of which is rising higher every day—to save TIME—to MAKE MONEY in steel plant operations of all kinds.

Buckets are in stock for immediate shipment.

Blaw Steel Construction Co.
602 Farmers Bank Bldg.
Pittsburgh, Pa.

You Will Have To Replace

YOU must make it possible for your men to produce more—whether in the mill, factory, machine or assembling shop, munition plant, or outside excavating or construction work, or on the farm. You can do it by using

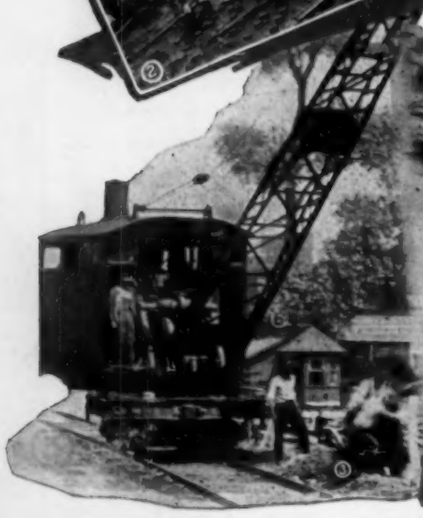
LINK-BELT

Illustration No. 1. Link-Belt Portable Wagon Loader. This machine loads a ton of loose material (such as coal) a minute. Does the work of 10 men and can operate 24 hours a day without fatigue. Handles any loose material. Write for catalog No. 270.

Illustrations Nos. 2 and 3. Link-Belt Locomotive Cranes. Can do the work of from 20 to 40 men. A Crane handles anything—coal, stone, logs, pig iron and structural steel, packages, boxes—weighing from 1 to 25 tons. Can be used as a switch engine. It can pull eight standard gondola cars on a straight track. Write for catalog No. 158.

Illustration No. 4. Shows one of many farm implements—the tractor—which are driven and operated through Link-Belt. We are the largest producers of malleable iron Link-Belt in the world—we are making millions of links for use on farm implements and furnishing thousands of feet of roller chain drives for tractors. The war will be won to a great extent on the farm, and we are extending every effort to keep our Link-Belt products to the highest point of production. Write for particulars.

Illustration No. 5. The Peck Carrier for handling coal, ashes, sand, stone, clinker and similar materials. This machine is a great labor saver—it can do the work of from 5 to 25 men, depending upon the amount of material handled. There are many types of bucket carriers, each adapted to certain conditions shown in our catalogs Nos. 110 and 120, sent on request.



The Men Uncle Sam Takes

YOU cannot fill the places of your men who are drafted to make up our fighting army abroad, but you can maintain your present rate of production with less help—and probably surpass it—by the use of modern labor saving and production-increasing

MACHINERY

Illustration No. 6. One of many types of Link-Belt Conveyors used in machine assembling plants—it would take a hundred men to do the work of this modern Conveyor, and they could not do it nearly so effectively. There are standard Link-Belt elevators and conveyors for every service—for handling any material—there is scarcely an industry which cannot be helped by the use of such labor-savers in times like the present. It will pay you to investigate now.

TELL us all about your problem. Let us suggest ways and means to help you do your work mechanically. These illustrations show only a few of our many types of labor-saving equipment. Remember Link-Belt Labor-Saving Machinery can often make one man do the work that ordinarily required 10 or more. Our experienced engineers can design a conveyor or elevator to fit your individual conditions and requirements. We have been doing this work for forty years—have helped many thousands—why not you? Write to us today.

Link-Belt Labor-Saving Equipment includes:—a complete line of Elevators and Conveyors with all accessories, Belt Conveyors, Bucket Elevators and Conveyors, Freight and Package Carriers, Electric Hoists, Coal and Ore Handling Machinery, Coal Tipples, Coal Washeries, Link-Belt and Sprocket Wheels, Silent and Roller Chain Drives, Transmission Machinery. Catalogs on request.

LINK-BELT COMPANY

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Buffalo	808 Ellicott Square	Toronto, Can.	Canadian Link-Belt Co., Ltd.
Wilkes-Barre,	2d National Bank Bldg.	Denver,	Lindroth, Shubart & Co., Boston Bldg.
Cleveland	420 Rockefeller Bldg.	Louisville, Ky.	Frederick Wehle Starks Bldg.
Detroit	732 Dime Bank Bldg.	Knoxville, Tenn.	D. T. Blakey, Empire Bldg.
Minneapolis	418 S. Third St.	Birmingham,	McCreesin & Darrah, Am. Tr. Bldg.
Kansas City, Mo.	407 Finance Bldg.	New Orleans	C. O. Hinz, Hibernia Bank Bldg.

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for STEEL PLANT
and FOUNDRY

Electric Motor Buckets

Clam Shell and
Orange Peel Buckets

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ENGINE CO.
Grand Haven, Michigan

New York Agent:
H. L. Drullard, 30 Church St.
Chicago Agent:
J. E. Chisholm, 1410 Fisher Bldg

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Pneumatic and Electric
Geared Hoists,
Steam and Air Motors,
Hoisting Engines,
Swinging Engines,
Motor Crabs, Drill Hoists,
Spud Hoists,
Marine Machinery, etc.

Write for Catalogue and Prices.

INCREASED PRODUCTION
It is a common occurrence for
BRIDGEFORD LATHES
to increase production 33 to 50%.
Put your lathe problems up to us. Twenty years' specializing in heavy duty lathe manufacture gives us the "Know How".
Heavy Duty Engine Lathes 24" to 48".
Axle Lathes—all types.
Bevel Gear Turners—up to 18" capacity.
BRIDGEFORD MACHINE TOOL WORKS
233 Mill Street Rochester, N. Y.

SPARTAN LEATHER BELTS
For Difficult Drives.
The Graton & Knight Mfg. Co. Worcester, Mass. U.S.A.

THE GENERAL ELECTRIC COMPANY
Has a motor for every service, a controller for every motor and skilled engineers to apply them to the best advantage.
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Sales Offices in
All Large Cities
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BOLT, NUT, FORGING and
WIRE NAIL MACHINERY
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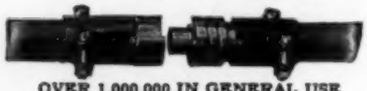

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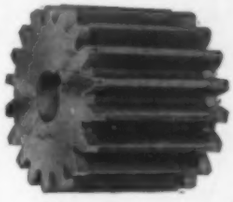

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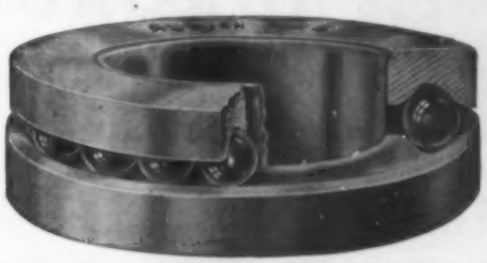

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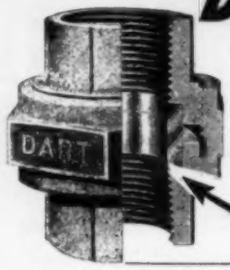

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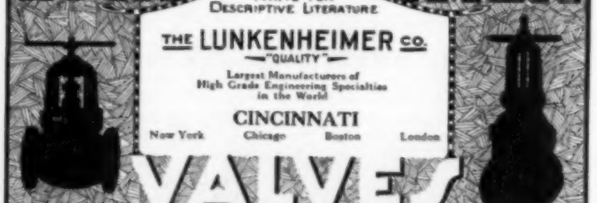

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THE SHENANGO FURNACE COMPANY

AMERICAN ZINC, LEAD & SMELTING CO.

American
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All grades for all purposes

Mascot
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Pig Lead

Sulphuric Acid

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PIG IRON—Foundry-Basic-Malleable
STEEL—Ingots-Billets-Bars
WIRE—Rods-Nails-Barbed Wire-Tacks
Market Wire of Every Description

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WICKWIRE STEEL COMPANY, Buffalo, New York

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BESSEMER PIG IRON—COKE
STEWART IRON COMPANY, LIMITED
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Works at SHARON and UNIONTOWN, PENNA.

Deep Metal Drawing,
Metal Stamping, Metal Spinning,
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THE BURR MANUFACTURING CO.,
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Notch, Bar and Ingot Metal
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THE GLOBE IRON COMPANY
JACKSON OHIO
JACKSON COUNTY SILVERIES
SPECIAL HIGH SILICON GRADES

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The
Dependable
Bessemer Ferro-Silicon

All grades—10 to 17% Silicon
PROMPT SHIPMENT
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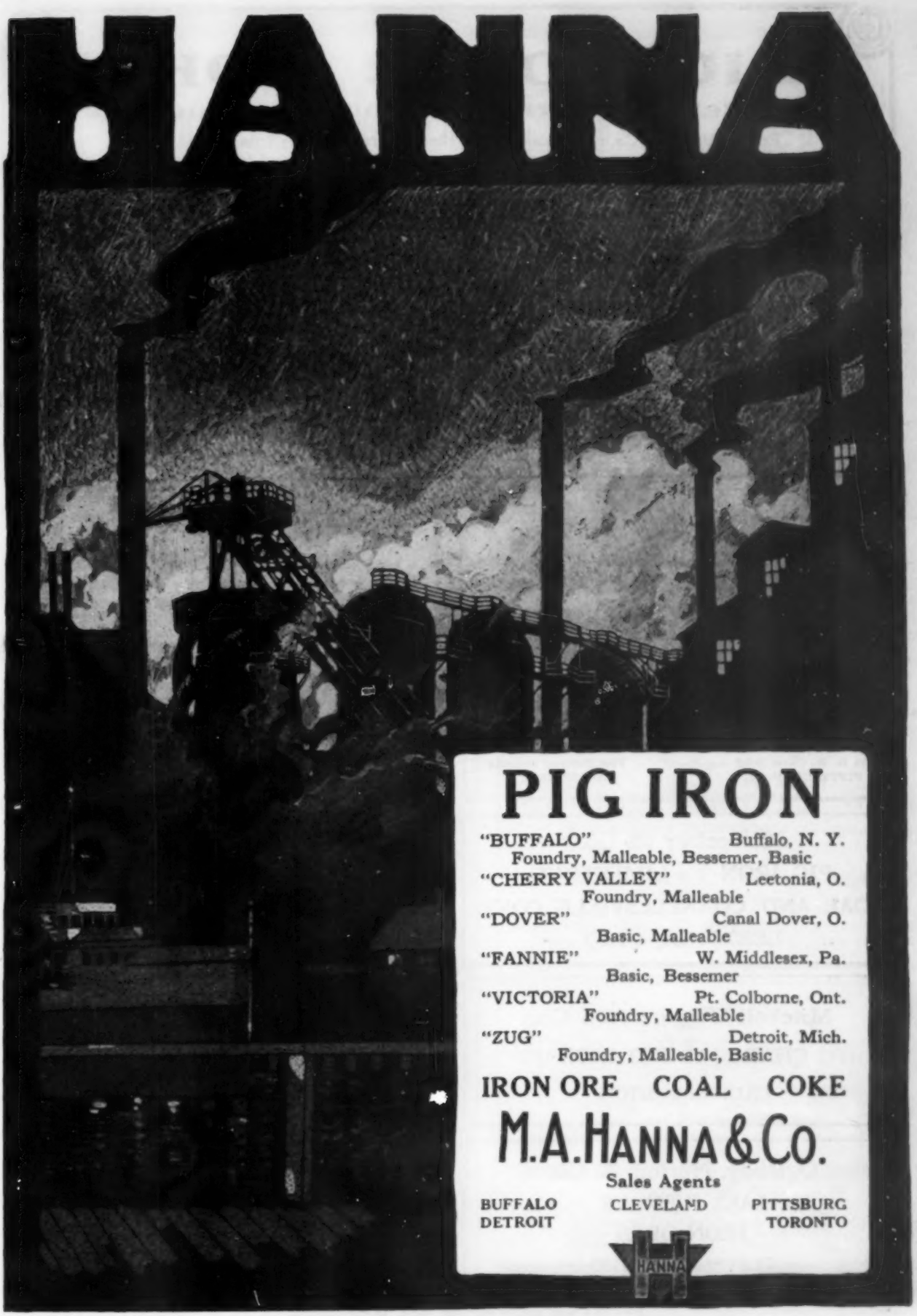

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Rogers, Brown & Co. representing more than 47 brands of Pig Iron and 37 brands of Coke offer to consumers, unsurpassed opportunities to contract for their requirements. Inquiries solicited.

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Makers of
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FREE FROM COPPER AND ARSENIC
MILWAUKEE, WIS.

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IRON ORES
CLEVELAND, OHIO

EUREKA FIRE BRICK WORKS
Established 1872 Incorporated 1904
"EUREKA" "BRADOC" "E. F. B." "VICTOR"
Manufacturers of High Grade Ground Fire Clay and Clay Fire Brick for Regenerator and Heating Furnaces, Boiler Settings and Arches, Stacks, Flues, By-Product, Rectangular and Bee Hive Coke Ovens.
Difficult Shapes Our Specialty
Office and Works, Mt. Braddock, Pa. Bell Phone 49, Dunbar, Pa.
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Immediate Shipment Dead Burned Dolomite

WRITE OR WIRE

BASIC PRODUCTS COMPANY

OLIVER BUILDING :: PITTSBURGH

HARBISON-WALKER REFRACTORIES CO.
MANUFACTURERS OF
High Grade Silica, Chrome, Magnesia and Fire Clay Brick
IMPORTERS OF
Chrome Ore and Spaeter Dead Burned Magnesite
PITTSBURGH, PA.

UNION MINING CO.
MT. SAVAGE, MD.
Proprietors of the
Mt. Savage Fire Brick Works
(SUCCESSFULLY OPERATED FOR 70 YEARS.)
Manufacturers of
"Mount Savage" "M. S. A." "Refracto" "Carburetor"
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1113-1117 Fidelity Bldg. Baltimore, Md. | Oliver Bldg. Pittsburgh, Pa. | 50 East 42nd St. New York, N. Y.

THE "CLEARFIELD" FIRE BRICK
MANUFACTURED BY
THE CLEARFIELD FIRE BRICK CO.
Office and Works at CLEARFIELD, PA.

"Salina" "Etna"

"Lyon" "Yough"
Established 1845 Pittsburgh, Pa.
Manufacturers of
HIGH GRADE FIRE CLAY AND SILICA BRICK

The Brick of True Efficiency
New Jersey Fire Clay Brick
are celebrated for their efficiency and economy. They are made from the best grades of New Jersey Fire Clay.
Write us.
Mutton Hollow Fire Brick Company
WOODBRIDGE, N. J.
Fire Brick; Cupola Linings; Boiler Arches and Special Fire Clay Products; Foundry Clays; Kaolin and Sands; Ground Fire Clays.

Jos. Soisson Fire Brick Co.
CONNELLSVILLE, PA.

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Employment

POSITIONS OFFERED

Minimum ad. set solid, 50 words $1.00
Minimum ad. all caps, 50 words $1.50

POSITIONS WANTED

Minimum ad. set solid, 25 words $.50
Minimum ad. all caps, 25 words $.75

(Each additional word set solid, 2c.—Each additional word all caps, 3c.)

Positions Offered

WANTED: — BASIC OPEN HEARTH Melter to act as Night Superintendent of Steel Foundry. To take full charge night gang including furnace gang with aid of good first helper. State experience, reference, salary. Address Box 451, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — COMPETENT MAN ON drop forge work, one who has had experience in forging shears, scissors, or surgical instruments preferred, state wages expected, age, experience, etc. Address Box 495, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — AN EXPERIENCED MEchanical draftsman; state salary required; experience, etc. National Tube Co., Riverside Works, Wheeling, W. Va.

THE BEST WAY TO GET A GOOD position in drafting or engineering is to file an application direct with some of our clients who are depending on us to get competent and experienced applicants for their vacant positions. Send stamp for blank and list of vacant positions. The Cleveland Engineering Agency Co., Rose building, Cleveland, O.

WANTED: — DRAFTSMAN, FAMILIAR with steel works construction. State experience and salary wanted. Address C. F. & I. Company, manager, Minnequa Works, Pueblo, Colo.

HELP WANTED:—WANTED AT ONCE, a number of first-class Mechanical and Structural Draftsmen, who have had experience in and are very familiar with steel plant work. The positions will be permanent. The work is located in a Southern City. Applicant to state age, give full experience and references; also state salary expected. Address Box 725, THE IRON TRADE REVIEW, Cleveland.

WANTED:—MAN CAPABLE OF TAKing charge of hardening room. Must be qualified to harden tools, cutters and flat ware dies. Good position for right man. Address Box 724, THE IRON TRADE REVIEW, Cleveland, O.

WANTED MAN WITH TECHNICAL education competent to repair and operate old blast furnace. Must be good chemist and with some experience in investigating undeveloped iron ore bodies. Pacific Coast Steel Co., Seattle, Wash.

WANTED FOUNDRY FOREMAN. GRAY iron, open shop, suburb of Chicago, furnace and stove plate work. Good chance for wide awake man. Give age and detailed experience and salary expected. Communications will be held strictly confidential. Address Box 715, THE IRON TRADE REVIEW, Cleveland, O.

WANTED:—MASTER MECHANic for blast furnace plant. Perry Iron Co., Erie, Pa.

DRAFTSMEN AND CHECKERS WHO are looking for steady employment write to United Engineering & Foundry Co., Farmers Bank Bldg., Pittsburgh, Pa.

WANTED: — EXPERIENCED MELTER to take charge of two malleable air furnaces. Address Box 735, THE IRON TRADE REVIEW, Cleveland, O.

Positions Offered

WANTED: — ELECTRIC FURNACE Melters and first helpers, also Open Hearth first helpers. Address Box 726, THE IRON TRADE REVIEW, Cleveland, O.

DESIGNER AND PRACTICAL BUILDer of power presses wantel by old established foundry and machine Company now considering building power presses. Address Box 722, THE IRON TRADE REVIEW, Cleveland, O.

EXPERIENCED FOUNDRY SUPERINtendent to have charge of large Gray Iron Plant in New York district. Address Box 740, THE IRON TRADE REVIEW, Cleveland, O.

WANTED:—FIRST-CLASS COREMAKER foreman accustomed to automobile work to handle approximately 60 coremakers; non-union man. Good salary to right man. Address Box 741, THE IRON TRADE REVIEW, Cleveland, O.

WANTED:—FOUNDRY FOREMAN FOR Steel Foundry must be young man neighborhood 30 years of age, good healthy type with strong personality and a man of experience in medium and heavy sized work, dry and green sand. Very excellent opportunity for the right man. Address Box 738, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — EXPERIENCED MAN TO take charge of hot pressed nut department, 26 machines. Address Box 736, THE IRON TRADE REVIEW, Cleveland, O.

WANTED: — STEEL BLOWER FOR one ton Tropenas Converter, state age, experience and salary expected in the first letter. Address Box 737, THE IRON TRADE REVIEW, Cleveland, O.

SALESMAN: — YOUNG MAN WITH mill experience in manufacture of Alloy Steels. Must be thoroughly familiar with physical properties, and heat treatments. State age, experience, references, and salary desired. Charles G. Stevens Co., 37 S. Jefferson St., Chicago, Ill.

Mr. Manufacturer

Here's the weekly exchange where Competent—wide-awake—industrious—men with initiative can be communicated with quickly.

51

Positions Offered

WANTED: — SUPERINTENDENT FOR acid open hearth steel foundry. Must be strictly sober, capable of handling general job work from one pound to ten tons. Address Strong Steel Foundry Co., Buffalo, N. Y.

WANTED:—MAN WHO THOROUGHLY understands the making of steel castings, converter process. Give particulars. Address Capital City Iron Works, Olympia, Washington.

Positions Wanted

PORCELAIN ENAMELING. A MAN OF WIDE EXPERIENCE WANTS A JOB TO BUILD OR OPERATE A PLANT. ADDRESS BOX 497, THE IRON TRADE REVIEW, CLEVELAND, O.

WHEN YOU NEED A HIGH GRADE executive, engineer, draftsman, or any technical man, consult The Engineering Agency, Inc., (Est. 24 years), 1662 Monadnock Block, Chicago.

YOUNG MAN EXPERIENCED IN every phase of electric furnace work, desires position as superintendent of furnaces. Especially well posted on upkeep of linings and roofs. College graduate and now employed. Address Box 727, THE IRON TRADE REVIEW, Cleveland, O.

I WILL PUT SNAP AND FORCE INTO YOUR CORRESPONDENCE WORK

Sales letters that make prospects buyers, or hold them in line for salesmen. General circular letter work. An enthusiastic good-will building contact with the trade. Descriptive and educational literature. Tactful credit, collection and complaint letters. A smooth quick acting system and better work with less labor.

Too busy to dictate? Just write your name and address on the margin and mail to Box 686, THE IRON TRADE REVIEW, Cleveland, O.

STEEL FOUNDRY SUPERINTENDENT, now employed, desires change where ability will be rewarded with bonus or stock in company. Address Box 730, THE IRON TRADE REVIEW, Cleveland, O.

I WOULD LIKE TO HEAR FROM some firm that is in need of a practical foundry foreman to take full charge of their foundry. Large shop preferred, medium and heavy work. At present have full charge of a good shop. Satisfactory reasons for wanting to change. Address 717, THE IRON TRADE REVIEW, Cleveland, O.

FOUNDRY SUPERINTENDENT OF wide experience in auto and general castings, good executive, foundry chemist and practically efficient. Address Box 731, THE IRON TRADE REVIEW, Cleveland, O.

COMPETENT GRAY AND MALLEABLE iron executive seeks position with good future for result producer. Age 36, now employed. Capable in all manufacturing departments, sales, purchasing, etc. Address Box 732, THE IRON TRADE REVIEW, Cleveland, O.

Opportunities

Agencies Wanted and Offered | **Investment of Capital** | **Plants for Sale Lease or Purchase**

ADVERTISING RATES: 1" One Time $2.50; 2" One Time $4.75; 3" One Time $6.75; 4" One Time $8.25
RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

Factory For Sale

Strictly up-to-date factory, composed of five detached, re-inforced concrete buildings, approximately 26,000 ft. of floor space, twelve acres of land, situated on belt line railway, Roanoke, Virginia, unsurpassed location, exceptional bargain. Immediate possession.

Jas. P. Gills, Agent
Box 641 Roanoke, Va.

For Sale Mild Steel Bars

Sixty-ton Mild Steel Flats, ⅜" x 5½" x 21'. Unused, perfect condition. Immediate shipment, bargain price.

Address Box 557
THE IRON TRADE REVIEW, Cleveland, O.

Machine Shop For Sale

Address Box 729
The Iron Trade Review,
Cleveland, O.

Agency Wanted

Live wire, well established firm, manufacturers' agents with office in Chicago can handle one more active account, either iron, steel or mechanical line. Well acquainted with railroad and industrial trade in Chicago territory.

Address Box 739
THE IRON TRADE REVIEW, Cleveland, O.

FOR SALE

Complete set of Drawings, Patterns, Jigs and a quantity of Material, for well-known Columbus Gas Engine from 4 to 25 H. P.

Number of Engines now in use - - - 18,000
Average Repair Parts furnished per month approximately - - $2,000

Will sell to responsible party, part cash, balance on time if required.

The Simplex Machine Tool Co.
712 Rockefeller Bldg., Cleveland, O.

Foundry and Machine Shop For Sale

Well equipped foundry and machine shop, now in operation at Billings, Montana. Large exclusive territory in farming, mining, gas and oil section. Good railroad facilities and splendid home market.

Address P. O. Box 1018
Billings, Montana

Charcoal Blast Furnace For Sale

Located east of Ohio River with wood land near furnace for several years supply charcoal and mining rights for large ore supply.

Address Box 699
THE IRON TRADE REVIEW, Cleveland, O.

CHROME ORE MANGANESE ORE IRON ORES

Anson G. Betts & Co.
Asheville, N. C.

Yours For Service All Ways And Always

EMPLOYMENT Department—For the Employer and Employe. The weekly exchange where employers meet employes equipped to comply with every exacting requirement;—where the experienced man finds a wide market for the sale of his services.

SECOND HAND MACHINERY Department—The weekly exchange for the purchase and sale of used equipment for the ore mine, blast furnace, steel plant, rolling mill, machine shop, foundry, forging plant, stamping works and metal-working industries generally.

FILL-IN AND CONTRACT WORK Department—The weekly exchange where the manufacturer can fill that department that is running light, with work for immediate shipment or on long time contracts. Where orders may be secured for stampings, iron, steel or brass castings, die, tank or boiler work, construction of special machines, building of patterns and models, experimental work, etc.

OPPORTUNITIES Department—For agencies wanted and offered; for the investment of capital and capital to invest; for the sale of plants, their purchase or lease and for a variety of needs involving representation or a desire to represent.

The Classified Department
THE IRON TRADE REVIEW
Cleveland, Ohio

Second Hand Machinery

Used Equipment of Metal-Working Plants

ADVERTISING RATES 1" One Time $2.50 3" One Time $6.75
2" One Time $4.75 4" One Time $8.25

RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

THE LIVE WIRE

Our Motto — Modern Tools — Lowest Prices — Honest Business

MILLERS

No. 1 Kempsmith Brand New Universal Miller.
No. 1 Cincinnati Used Universal Miller, dividing heads, vertical head rack and spiral cutting attachment.
No. 1½ American Brand New Plain Miller.
No. 1½ Rockford used plain Miller with dividing heads complete.
No. 2 LeBlond used Universal Miller with dividing heads complete.
No. 2 Kempsmith Brand New Miller dividing heads complete.
No. 2 Cincinnati Brand New Universal Miller, dividing heads complete.
No. 4 LeBlond Brand New Universal Miller, dividing heads complete.

LATHES—ENGINES

18 x 10-ft. used Hendey Yoke Head, Q.C.G., complete.
18 x 8-ft. used Reed Lathe, taper attachment, complete.
18 x 8-ft. used American, Q.C.G., complete.
30 x 16-ft. used Lodge & Shipley, Q.C.G., complete.

MISCELLANEOUS

No. 7 Langelier Hot Swaging Machine, complete with work holder and new three plunger pump, also valve for drilling operation of the work holder, capacity 3 in. stock size of dies 2½ x 3¼ x 6 in. long.
29 Spindle Moline Drill Press.
No. 5 Bath Duplex Cylinder Grinder.
No. 31 S. Bliss Power Press.

TURRET LATHES

3—3 x 36 Jones & Lamson geared sliding head, single pulley drive, bar equipment.
7—3 x 36 Jones & Lamson geared head, bar and chuck equipment.
2—2 x 24 Jones & Lamson geared head, bar equipment.
1—2 x 24 Jones & Lamson geared head, bar and chuck equipment.

AUTOMATICS

No. 54 National Acme, 4 spindle, 1⅜ capacity, S.P.D.
No. 55 National Acme, 4 spindle, 1⅛ capacity, S.P.D.

RADIAL DRILLS

5-ft. Bausch-used, massive pattern, plain.
5-ft. Niles used, massive pattern, plain.

SHAPERS

1—14-in. Kelly used Crank Shaper, complete.
1—16-in. Stockbridge Crank Shaper, complete.
1—16-in. Smith & Mills, back geared, complete.
1—16-in. Gould & Eberhardt, back geared, complete.
1—20-in. Ohio Shaper, back geared, complete.
1—22-in. Gould & Eberhardt, back geared, complete.
1—24-in. Steptoe, back geared, complete
2—24-in. Brand New Milwaukee back geared Shapers.
1—24-in. Brand New American double back geared Shaper.
1—28-in. Brand New American double back geared Shaper.

We own over 500 new and used machine tools of every description. Send for catalogue.

MODERN MACHINERY EXCHANGE, 56-58 Walker Street, New York City

Shell Making Machines For Immediate Delivery

64—6" Shell Making Machines with all attachments.
25—9.2 and 12" Shell Making Machines, some arranged for motor drive, and others for belted drive.

For further particulars inquire of

The Cleveland Machinery & Supply Co.
Cleveland, Ohio

Used Machinery

Anything you want

State your requirements.

RARE TOOLS AND MACHINERY

Schlieper Engineering Co.,
714 Ferguson Bldg. Pittsburg, Pa.

For Sale Cheap For Cash

One 38" Automatic Knife Grinder
One Hill Drag Saw complete with No. 0 Engine
One 4 H. P, Upright Steam Engine
One 40 H. P. Upright Shepherd Steam Engine
Four blowers 24 to 28" fans
One Dey Time Register Clock
One Splint Chopping Machine
One Tray Riveting Machine
One No. 1 Mead Chemical Grinder
Three Weist Tray Machines 100 to 500
One Tube Machine makes, prints and sands
One Special Sanding Machine
One 60" Columbia Slitter and Rewinder
Two Veneering Machines, 28 and 43" blades
Three Mixing Machines
Two Point Grinders
All kinds of match machinery
All kinds of belting, shafting, etc.
All kinds of chemicals and laboratory equipment
Bargain Prices and Immediate Delivery For Cash.

JAS. P. GILLS, Agent
P. O. Box 641 Roanoke, Va.

BUY THIS GAS ENGINE

Rebuilt 60 H. P. Lazier Gas Engine. 2 Cylinder, Vertical type with piston valves and all working parts enclosed. Auxiliary self starter, Bosch H. T. Magneto, water cooled, exhaust mufflers and gasometer. A complete power plant ready for installation.

Cleveland Machinery & Supply Co.
Cleveland, O.

BENDING ROLLS

Bement, Miles & Company Pyramid Style Engine Driven, capacity 10' 6" x 1" plate, upper roll extended for counterbalancing and hinged housing, weight 22 tons, splendid condition, immediate shipment.

Russell Machine Company
Pittsburgh, Pa.

CHICAGO HOUSE WRECKING CO.

"World's Leading Buyers and Liquidators"

FACTORIES—RAILROADS—COMPLETE PLANTS—ESTATES, Etc.

We now offer the "cream" of America's material and equipment from our latest purchases. Here are a few items, for quick buyers, from our tremendous stocks:

AVAILABLE AT ONCE FOR IMMEDIATE DELIVERY!

AMERICAN AND BALDWIN **63 and 73-Ton Locomotives** AMERICAN AND BALDWIN

63 and 73-ton Mogul, 6-wheel, standard gauge locomotives; 180 lbs. pressure. In actual service less than 5 years. Comply with all Federal Laws. Blue prints and complete specifications on request.

STEEL! For Immediate Delivery!!

We have the following Structural Steel Material on hand for immediate shipment, subject to prior sale:

Channels

100—Tons 8⅝" Channels 18 lbs. to the foot, 14' long.

"I" Beams

100—Tons 15" "I" Beams 50 to 80 lbs. to the foot, 20' long.

Columns

16—Z Bar Columns 40' long, weight 100 lbs. to the foot, will cut to length.

Steel Plate

200—Tons Steel Plate, ¼" by 46", 6' to 8'.
200—Tons Steel Plate, $\frac{5}{16}$" by 46", 6' to 8'.
100—Tons Steel Plate, $\frac{3}{16}$" by 46", 6' to 8'.
200—Tons Steel Plate, ⅜" by 3' to 6' wide, 6' to 12' long.

Bridges

1—120' Clear Span Highway or Light Railroad Bridge, Coopers E-30 loading, weight approximately 76,000 lbs.
4—126' Deck Spans, single track railroad bridge, Coopers E-40 loading.

Plate Girders

2—32" deep, 54' long Plate Girders, 12,000 lbs. each.
4—60" " 61' " " " 25,000 " "
2—88" " 72' " " " 35,000 " "
2—88" " 80' " " " 39,000 " "
25—18" " 27' " " "
10—30" " 20' " " "
6—18" " 25' 8" long Plate Girders.
2—38" " 22' " " "
2—43" " 25' " " "
6—18" " 25' 8" " " "

Lattice Girders

24—Lattice Girders, 40' long, 5 feet deep, weight 4,000 lbs. each.
2—30" deep 39' long Lattice Girders.

Roof Trusses

18—50' Flat Roof Trusses.
16—40' " " "
5—28' " " "
20—20' " " "
3—27' " " "
24—42' Fink Pattern Roof Trusses
6—77' " " " "
7—28' " " " "
20—20' " " " "
60—13' " " " "

Reinforcing Material

20—Tons ¼" Round Rods.
50— " ⅝" " "
5— " 1⅛" " "
20— " 1¼" " "
5— " 1⅛" Square Twisted Bars.
5— " $\frac{7}{8}$" " Deform'd "
5— " 1⅛" Round " "
15— " 1" Square Deform'd "
5— " 1" Round " "
10— " 1" " Bars.
15— " ¾" " "
10— " ⅞" " "

ROLLING MILLS! Available Now!!

1—16" Puddle mill, 2 stand, 3 rolls high: direct connected to one 24" x 48" Corliss engine; complete with full set of rolls, patterns and spares.

1—10" Bar mill; 4 stand with 18"x 30"heavy duty steam engine, complete with full set of roughing finishing rolls, patterns and spares.

1—9"Bar mill, 5 stand; connected to 18" x 42" Corliss engine; complete with full set of roughing and finishing rolls, patterns and spares.

We Also Have in Connection with These Mills the Following:

1—Lewis Foundry & Machine Co., squeezer, direct connected to heavy duty steam engine.
1—250 H. P. Hyde waste heat boiler, connected to 4 section furnace.
2—250 H. P. Hyde waste heat boilers, each connected 3 section furnaces.
5000 square feet cast iron floor plates.
1—6' wide x 75' long hot bed.
1—10' x 75' long hot bed.
1—Hot scale.
50,000 furnace fire brick.

Write for complete blue prints, specifications and description

160 Page Current Stock List Now Ready—Ask for Your Copy, No. IR 303

PHONE! —— WIRE! —— CABLE! —— WRITE!!

Cable Address "Recking" Chicago A. B. C. Code

ADDRESS **HARRIS BROTHERS CO.** OWNERS

35th and Iron Streets, CHICAGO

Telephone All Departments Yards 1900

Sell That Outgrown Equipment

Supt.—Mr. Smith, I see a mighty good chance to get that additional floor space you were talking about the other day.

G. M.—Where, Jim?

Supt.—It's in the back end of the machine shop where the old boring mill, lathes and planer are stored and which have been occupying valuable space since the new equipment was installed.

G. M.—Well, what about that, Jim?

Supt.—Why not sell them? We don't need them any more; in fact we can't use them.

G. M.—But nobody would buy that stuff.

Supt.—They wouldn't, eh? Why, that equipment is in fine condition. The only trouble is that we've outgrown it. There's a big demand for all kinds of machine tools right now and my suggestion is that we advertise the whole lot for sale. Did you ever read THE IRON TRADE REVIEW'S Second-Hand Machinery section? Here's a copy. Look it over.

G. M. (After reading the Second-Hand Machinery section of THE IRON TRADE REVIEW)—Well, Jim, you're right. There certainly seems to be a big demand for second-hand machinery and equipment. Make up an ad and send it in tonight and tell them to run it four times.

Second Hand Machinery

Used Equipment of Metal-Working Plants

ADVERTISING RATES 1" One Time $2.50 3" One Time $6.75
2" One Time $4.75 4" One Time $8.25

RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

Cold Rolled Shafting For Sale

2500 pieces 1-15/16" cold rolled steel shafting, 75 inches long. .08 to .11 carbon. Make me a bid.

R. F. FLURY
1506 Fort St., W., Detroit, Mich.

ELECTRIC Traveling Crane For Sale

One Browning Overhead Electric Traveling Crane, 40' span 30-ton capacity, 5-ton auxiliary hoist, 230 volt motors. In first class condition and for immediate delivery. Can be seen at

National Foundry Company
Erie, Pa.

Partial List Of Our Practically New Machine Tools

(1) No. 3 "Cincinnati" High Power, Single Pulley Drive, Universal Milling machine, with vertical attachment and all regular equipment. Equal to new.
(1) New, No. 1½ "Valley City" Universal Milling Machine, complete with all regular equipment.

LATHES

(6) 16 x 8 "National" Quick Change Feed Lathes, compound rest, power cross feed, complete regular equipment. Nearly New
(2) 16 x 8 "Greaves & Klussman" compound rest, power cross feed, complete regular equipment. Nearly New.
(1) 22 x 10 "Reed" compound rest, power cross feed, complete regular equipment. Perfect Condition.
(1) 18 x 8 "Sidney" double back gear, heavy duty lathe, compound rest, power cross feed, complete regular equipment. Nearly New.
(1) 18 x 8 "Barnes" Lathe, compound rest, power cross feed with extra turret for cross slide. Good Condition.
(4) "Reed" 14 x 6 Lathes, elevating rest, power cross feed. Regular equipment. Perfect Condition.

This list represents only about 1% of our stock. Send us your inquiries. Single tools or entire plants purchased.

Manhattan Machinery Exchange
Office, 30 Church Street
Warehouse, 4-6 White Street, New York City

IMMEDIATE DELIVERY

Subject to Prior Sale

Heavy Service Gate Shear, capacity 72" x 2".
1—42" x 48" Stroke Non-Condensing Slide Valve Mackintosh-Hemphill Engine. Diameter flywheel 25' 0"; weight of flywheel 25 tons; estimated total weight of engine 60 tons. Has driven 112" Plate Mill.
32" 2-High Blooming Mill and Engine.
Overhead Electric Traveling Cranes of various spans and capacities.
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1—Gray Iron Foundry Ladle. 15 tons cap. Top pour.
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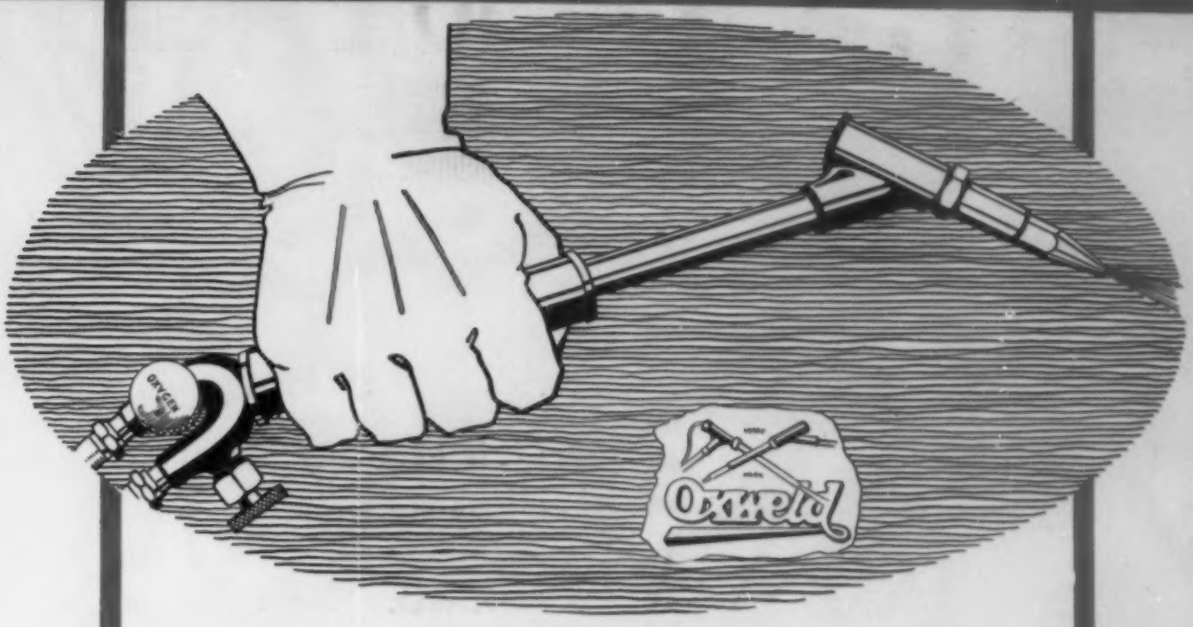

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